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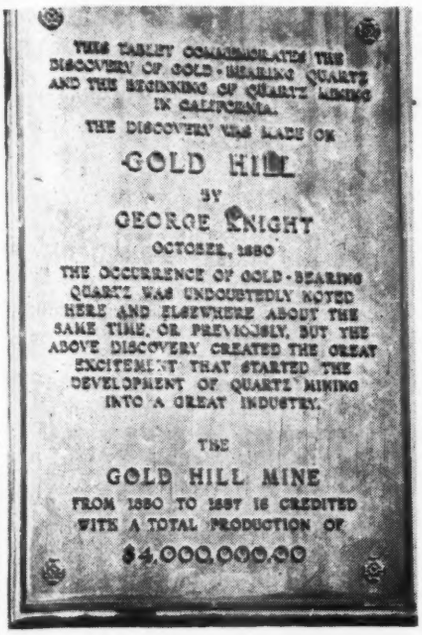
ON THE COVER



ON GOLD HILL, just outside of Grass Valley, Calif., is the rustic monument pictured on our front cover. It bears the bronze marker reproduced above. Although copper and iron ore had been previously mined in the United States, this discovery inaugurated the mining of lode gold and started a memorable surge of humanity to the west coast. California had already yielded considerable gold, but all of it had come from placer deposits.

The find by George Knight made Grass Valley the cradle of the nation's gold mining and milling technology. Having the ore, the pioneers had to find some way of extracting its metallic treasure. Thus necessity became the mother of the invention of the stamp mill by Judge James Walsh (he got the title by being chosen justice of the peace in Grass Valley's first election, November, 1850). In this machine, improved forms of which are still in use, multiple falling weights or stamps crush the ore and liberate the gold, which is collected by amalgamation with mercury.

A need for mining laws was also created by the strike and the quartz miners of Nevada County met in informal session to frame them. These regulations formed the basis of statutes that were later adopted in all the western gold-mining states. The annals of the section also mention the invention of a rock-drilling machine by a man named French. Details of the device were not handed down by the historians. Innovations of apparatus and processes relating to the working of placer deposits are also credited to the Grass Valley area. These include the Long Tom, the under sluice, the waltzing pan, and the practice of caving and breaking up gravel banks with explosives.

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ADVERTISING INDEX

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California Looks Back on Its Gold Rush

Allen S. Park

PHOTOS BY CLAUDE FERGUSON

GRASS VALLEY AND PLOT IT WAS NAMED FOR

A view looking westward across Grass Valley from a plane at 1200 feet altitude. Founded by the Argonauts of 1848 and nurtured by gold mining, this community of 12,000 persons is now supported by varied industries, of which lumbering is the most important. In normal times, however, it and the remainder of Nevada County account for two-fifths of California's lode-mine gold production. The first settlers chose the town's name from a grassy meadow where their cattle, gaunt from being driven overland, feasted. The area is now set aside as Memorial Park and provides recreational facilities for the community (upper picture).

MINING men of the nation are this month converging on California, the scene of the lusty gold boom of a century ago that laid the foundation of the great western empire. At San Francisco, during the week of September 20, the American Mining Congress will convene for its biennial convention and exposition. Supplementing the six general and four special sessions of technical papers and discussions will be the usual displays of the latest types of machinery for producing ores and extracting their wanted contents. The two closing days will be devoted to tours of the state's historic gold fields and inspections of the tunnel-driving operations being conducted by the Pacific Gas & Electric Company to augment and improve its hydroelectric generating facilities.

The visitors will see little to inspire them in the current gold-mining operations. With the price of gold pegged by government edict at $35 an ounce for the past fifteen years, any literal-minded person can figure out how that branch of the mining industry is faring under the impact of the ever-rising spiral of wages and equipment costs. Floating dredges working the placer deposits of the Sacramento and Yuba valleys are fairly active, because even a large unit of this type can be run by three men. The giant machines available can dig 110 feet below the surface, and some of them are profitably processing ground that has been worked twice before but to shallower depths.

The lode mines, however, are in a different category. Wages make up the biggest item in their costs, and the prevailing scale is too high for most of them to bear. Inevitably, then, they have had to close down, one by one. Many of them never even reopened following the wartime shutdown enforced by government restrictions. Only a few have rich enough ore to keep them going now. Production figures tell the dolorous story quicker than words: In 1940, California's placers and lode mines yielded $51,000,000 worth of gold; in 1945 their output had a value of $5,000,000, a decline of more than 90 percent. Consequently, a trip through the gold diggings may be likened to walking into a movie house a few minutes before the final show of the day closes. A few stragglers are scattered around in a sea of seats, and it is evident that most of the crowd has gone elsewhere.

However, the lack of current activity does not dim the aura of the past. The sight-seers will tread ground where mining history was made. They will look at structures that were once associated with important persons and events. They will see mines that have been operating for well-nigh a full century. In now prosaic settings, the more imaginative will conjure up visions of the 1850's. They will see phantom bearded figures in high boots and rough clothes digging feverishly for the yellow metal by day and throwing it around prodigally by night. James W. Marshall, Mark Twain, James W. Mackay, James G. Fair, Black Bart, and many others will be in the procession of notable and notorious personages that marches before their mind's eye.

In the once fabulous Mother Lode district—embracing the counties of Amador, Calaveras, Eldorado, Mariposa, and Tuolumne—the visitors will find ample evidence of past mining glory but sparse current activity. Little mineral has come from the ground there during the past two or three decades. This does not mean that it is a region of ghost camps. On the contrary, it is dotted with

MAP OF 1849 "NORTHERN DIGGIN'S"

A decorative pictorial guide to the leading gold camps, with the network of modern highways superimposed on it. The map was drawn by Dillon Lauritzen for the Grass Valley Chamber of Commerce.

thriving communities that now derive their principal income from farming, stock raising, and lumbering. They will also see some sizable mining plants that are shut down but not abandoned. Their owners have only closed the doors temporarily, like shopkeepers gone to lunch. They are biding their time and hopefully awaiting a turn of the economic wheel of fortune that will permit them to resume business. No one can predict just how long this hiatus will last, but gold miners are traditionally the world's greatest optimists with the patience of Job, and they will wait.

In this Mother Lode country, Calaveras County is especially rich in lore of the past. Angels Camp, Mokelumne Hill, and San Andreas are the better-known century-old settlements that have survived the kaleidoscopic changes. It was in Angels Camp that Mark Twain wrote *The Jumping Frog of Calaveras County* in the 1860's. One of his favorite haunts, the Hotel Angels, still stands and is headquarters for the annual Jumping Frog Jubilee. This hostelry was

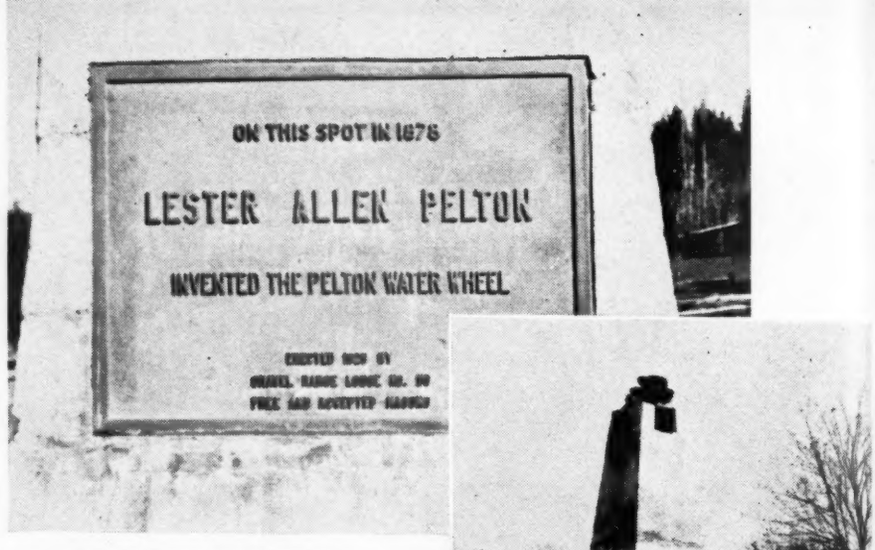
originally a canvas shelter put up in 1851 by C. C. Lake. It soon gave way to a wooden structure which, in turn, was torn down in 1855 to be replaced by the present stone building to which a second story was added in 1857.

It was in Angels Camp, also, that Mackay and Fair laid the foundations of their mining fortunes. Mackay went on to organize the Postal Telegraph Company, now merged with Western Union, and some of his wealth was spent in stringing the first transatlantic cable. Fair's name and part of his fortune are preserved in the Fairmont Hotel in San Francisco, still one of the city's leading stopping places.

Angels Camp came into being in July, 1848, when Henry Angel dropped out of a party led into the area by James H. Carson. He established a trading post there, while the others went 3 miles beyond to open a camp known as Carson's Hill. Among Angels Camp's early settlers was a man with the almost unbelievable name of Bennager Raspberry, and he was destined to bring the town into the limelight. Legend has it that he jammed the ramrod in his gun barrel while out hunting one day. To release it he adopted the somewhat foolhardy course of aiming the weapon at a squirrel and firing it. The ramrod uprooted a bush, and when he went to retrieve it he saw yellow metal adhering to the upturned rocks.

Although the vein thus disclosed did not persist with depth, its discoverer dug as much as $7000 worth of gold a day from it for several months. News of the find brought a horde of prospectors, and other mines were soon developed, among them the Marshall, Crystal, Matson, Gold Cliff, El Dorado, Confidence, and Utica. By 1853, the camp had 4500 inhabitants. It was twice partially destroyed by fire in the 1850's, but some of the original buildings, including the hotel, survive.

Mokelumne Hill was similarly founded in 1848 by a trader who opened a store there. In the following year it was settled by former soldiers of a New York regiment that had been sent into the region in 1847 to participate in the Mexican War. "Moke Hill," as the camp was popularly known, had a brief international war in 1851. Discovery of rich ore by a group of Frenchmen drew several thousand Americans, some of whom eyed the strike so covetously that the frightened foreigners put up a small fort for protection. It was reported, but never substantiated, that the Frenchmen raised their national flag, an act the Americans used as an excuse to chase them away and confiscate their holdings. Other finds swelled the population to between 3000 and 4000, and the camp was the county seat from 1852 to 1866. The mineral wealth gradually gave out, however, and Mokelumne Hill now has only



MEMORIAL TO PELTON
Monument and marker at Camptonville, 30 miles north of Grass Valley, commemorating the invention there of the impulse water turbine by Lester Allen Pelton.

500 or 600 residents. Joaquin Murietta, notorious outlaw, lived in the Hill with five of his gang in 1852, where they occupied themselves mainly with gambling and petty thievery while planning large-scale holdups farther afield.

San Andreas was established in 1848 by Mexicans, and they represented the bulk of the population of around 1400 by 1850. In that year, many of the residents stampeded to Mokelumne Hill in an effort to get in on the rich strikes there, but most of them returned within a few months. The highwayman career of Charles E. Colton, alias Black Bart, came to an end in San Andreas after he had eluded peace officers for eight years. He was captured on November 3, 1883, while robbing a stagecoach near Copperopolis and taken to San Andreas for trial. He received a sentence of six years, but was released after four years and two months on account of good behavior.

Nevada County is another section where the luster of bygone days still gleams brightly and where the most productive of the state's remaining active underground gold mines are located. At Grass Valley, a modern city of 12,000 people with eleven churches, two banks, and 2500 telephones, Empire Mines Company, Ltd., is operating the nation's oldest gold mine with a record of continuous output since 1850. The Idaho-Maryland group, also still hoisting ore, claims a total yield second only to the famous Homestake of South Dakota. Prior to World War II, Grass Valley workings were producing an average of $11,000,000 worth of gold a year. In 1940, Nevada County contributed 22 percent of California's $51,000,000 gold "crop" and 40 percent of the portion that came from lode mines. At present, lumbering is more lucrative than mining, and the surrounding vast stands of virgin timber are processed in 27 sawmills.

Gold seekers treking to the mother-lode region by way of Truckee Pass paused on the site of Grass Valley in the late summer of 1849. Some of their cattle strayed and were found in a grassy meadow along Wolf Creek, a circumstance that gave the town its name. It was a desirable place to camp, and eight or ten cabins were built in Boston Ravine half a mile from the meadow. Placer mining netted good returns until the spring of 1850, when the water gave out and the party left. About that time the Rhode Island Company opened a store in Grass Valley on what is now Main Street.

In October, 1850, while chasing an errant cow across rocky terrain, a man by the name George Knight scuffed a hob-nailed boot against a projecting ledge and broke off a piece. The fracture revealed streaks of gold. The spot was named Gold Hill, and a monument there marks it as the place where quartz mining began in California. Hundreds of miners attracted by the news combed the section and made further discoveries. Knight's claim is said to have yielded $1,500,000 in metal and another one 150 feet away $4,000,000. The state's first stamp mill was erected there, and others soon followed. The Empire and North Star mines, operated as one property since 1932, have produced $80,000,000

of the $193,500,000 output attributed to the Grass Valley District. The all-time yield of Nevada County is recorded as $378,000,000. Underground lateral workings of the Grass Valley mines are said to total 300 miles.

Among the celebrities who once lived in Grass Valley was Lola Montez, international dancer who was born Marie Dolores Eliza Rosana Gilbert, the daughter of a British army officer. Following a divorce from a Captain James of the Indian army in 1842, she studied dancing. As Lola Montez, she made an unsuccessful debut in England, but subsequently became a favorite in the theaters of the Continent. While appearing in Munich, King Ludwig I of Bavaria became infatuated with her and she soon became the power behind the throne. She brought Ludwig into conflict over religious matters with the head of his ministry, Karl Abel, and he opposed her application for citizenship. Thereupon, Ludwig replaced the ministry with one that would do his bidding, and Lola was naturalized and became the Countess of Lansfeld with an income of $10,000 a year. But so much pressure was brought to bear upon the king that he exiled the dancer in 1848.

Upon being banished, the young woman returned to England, but came to America in 1851 and somehow found her way to Grass Valley, where she remained for some time. While there, she became interested in a teen-aged, red-headed girl who lived nearby and taught her to sing and dance. Her pupil was Lotta Crabtree, who appeared successfully in this country and Europe.

Next to Grass Valley, Nevada City commands the most interest among the old gold camps of Nevada County. One of the first persons to visit the site was James Marshall, the New Jersey millwright who touched off the gold excitement in California by discovering flecks of the yellow metal in Sutter's millrace at Coloma. Marshall didn't tarry at Coloma, but went on to seek other placer deposits that he might claim as his own. In the summer of 1848 he was busy panning the gravels of Deer Creek, where Nevada City was built, but found nothing of value and went his way.

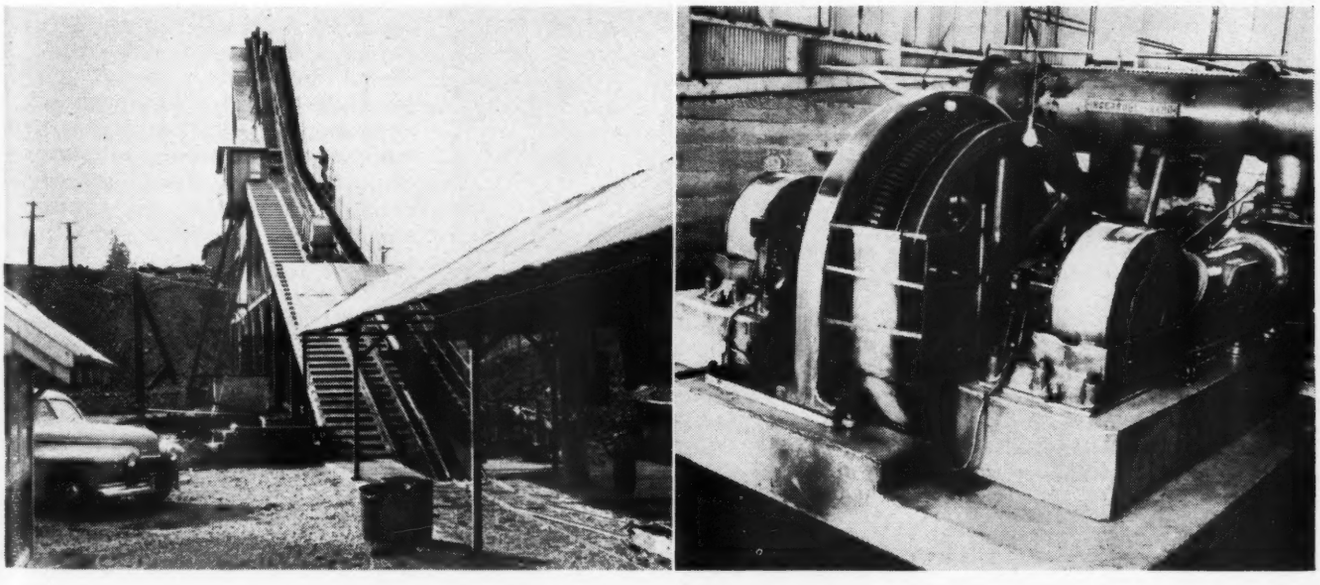
In October, 1849, Dr. A. B. Caldwell put up a log-cabin store on what is now known as Aristocracy Hill. That attracted a few miners, and it was not long until they discovered rich placer deposits which are reported to have yielded $8,000,000 in two years. Those returns were dwarfed, however, by the wealth that later poured from the lode mines such as the Champion, Providence, Marrifield, Wyoming, Pittsburgh, and New England. Some of these properties were profitable until World War II started, but they are mostly dormant now, awaiting more favorable economic conditions. The settlement, which attained a population of 10,000 when it was only two years old, was at first called Caldwell's Upper Store and also Dry Creek Dry Diggings, but in 1850 the miners voted to change its name to Nevada. Ten years later, when the State of Nevada was created, the camp amended its title to that of Nevada City.

The Pacific Gas & Electric Company, now one of the nation's leading utilities, was born in Nevada City. Its nucleus was the Nevada County Electric Power Company, which constructed a power plant 5 miles away on the South Fork of the Yuba River. This concern, with offices in Nevada City, was later absorbed by the Bay Counties Power Company, one of a group that afterward became the Pacific. The Bay Counties company is credited with having built the first long-distance line for transmitting power from a water plant at Colgate to San Francisco.

The University of California owes its origin to a meeting held in Nevada City on May 17, 1853, at which the Congregational Association of California and the Presbytery of San Francisco voted to establish an institution of learning. That was a preparatory school, called Contra Costa Academy, and was located in Oakland. From it grew the College of California, which became the University of California in 1868.

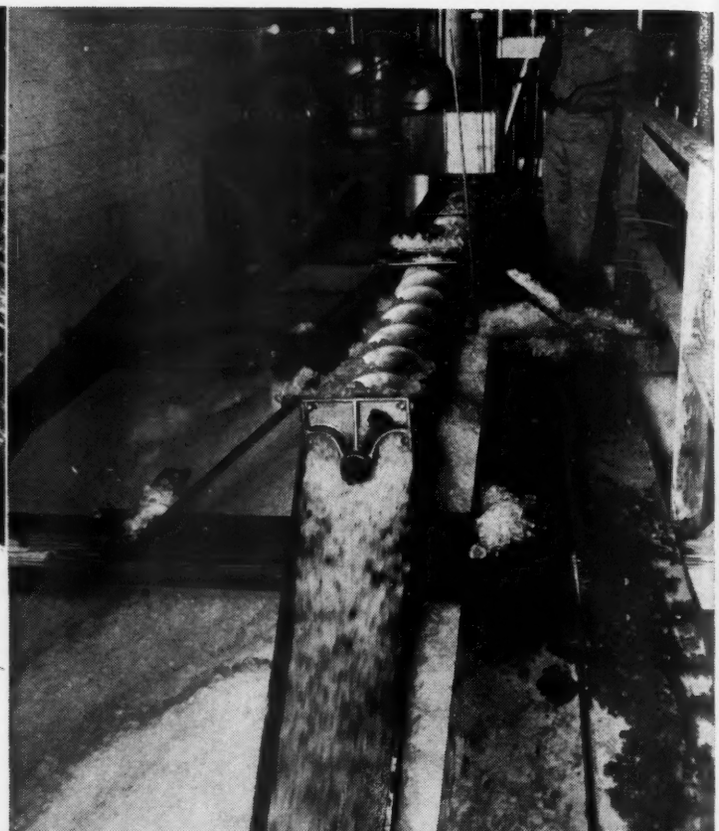
Nevada City boasts that it has the oldest commercial airport in the United States. In operation since 1907, it was established by Lyman Gilmore, a pioneer aviator. After experimenting with wings attached to a bicycle, he constructed his first glider in 1891. Two years later he flew a glider 500 feet, reaching a height of 50 feet. In after years he designed planes with steam and gasoline power plants and is credited with having built twenty machines.

From an assay office in Nevada City that is still run by a son of the founder, James J. Ott, the world got its first news of the discovery of the fabulous Comstock Lode, across the Sierra in Nevada. There being no assay facilities nearby, the first samples were sent to that California camp for testing. Today, Nevada City has a population of 3000 and a street system as tortuous, but not so long, as Brooklyn's. Local residents say the thoroughfares follow the trails originally made by the trains of prospectors coming down from the hills.



OLDEST HEADFRAME AND VENERABLE COMPRESSOR

Surface structure, left, over the original shaft of the North Star Mine at Grass Valley. The inclined shaft, now open to the 6300 level, was sunk in 1850 and has been worked ever since. The Ingersoll-Rand compressor pictured at the right has been in almost daily service at the Empire Mine since 1915 and is still its chief source of air.



Icing Lettuce for the Nation's Salad

L. A. Luther

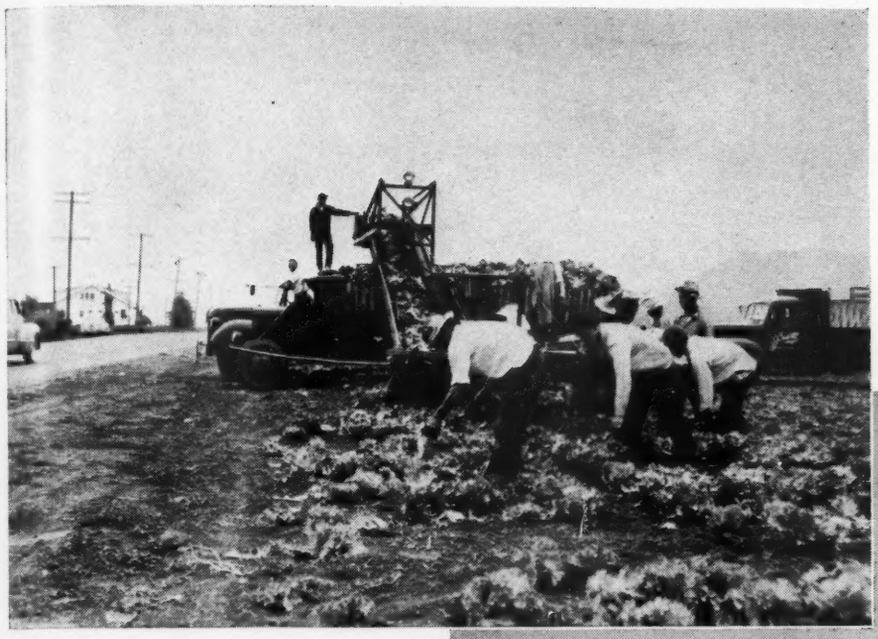
ICING CRATES OF LETTUCE

Sized ice is conveyed to an overhead 150-ton storage room (above). Other conveyors withdraw it as needed and distribute it to the packing lines. In the general view of the packing room, left, large baskets of lettuce that have been brought in from the fields are on the right and empty crates to be packed and iced are on a conveyor at the left. The picture of a crate of lettuce shows the top course being placed on a layer of ice.

THOUGH we eat thirteen times more salads now than we did in 1918, it isn't because of millions spent in advertising. The publicity-minded cigarette business is a poor second, with output multiplied by only eight in the three decades. Everybody, except perhaps a few dyspeptics, seems to approve of the salad habit, and it doubtless has grown pretty much in ratio to quality and availability of the makings. Lettuce probably is most universally used, and ice to preserve it and other salad greens in transit is essential to the industry which our salad-eating has created. Very large tonnages are consumed daily by plants packing these perishables for long-haul shipment, and some of it is provided by facilities that make so-called tube ice virtually at the pressure of a button.

J. J. Crosetti & Company, which packs lettuce and tomatoes at Watsonville, Calif., has recently placed such a plant in service. It is based upon the tubular-freezer principle by which ammonia is circulated through round, vertical freezers housing nests of tubes through which water is passed to produce ice. Economy of operating and high constant output have led to the use of the method on several concrete-dam projects for the purpose of supplying large quantities of ice to lower the initial temperature of the mix and thus to compensate for the heat of hydration or setting induced by chemical reactions in great masses of concrete. One such application was described and illustrated in the March, 1948, issue of this magazine under the heading, *Ice in Mix Precools Concrete for Dams.*

The fact that refrigeration reduces spoilage of foodstuffs is of small concern to the dam builder, but it does appeal strongly to those who depend on the famous "Salad Bowl" of Monterey County, California, for the crisp leaves which are so much in demand that lettuce growing there is now a major industry. Actually, to put the business on a sound basis, packing and icing had to be developed in advance of the various methods that have made the cultivation of lettuce and other perishables a veri-



HARVESTING LETTUCE

Farm hands of both sexes, most of them American-born Japanese, pick the heads and place them on the arm of the conveyor, which spans thirteen rows of plants. They are then elevated and deposited in large baskets on the truck. Both vehicles move across the field at the same speed, which is equivalent to a slow walk.

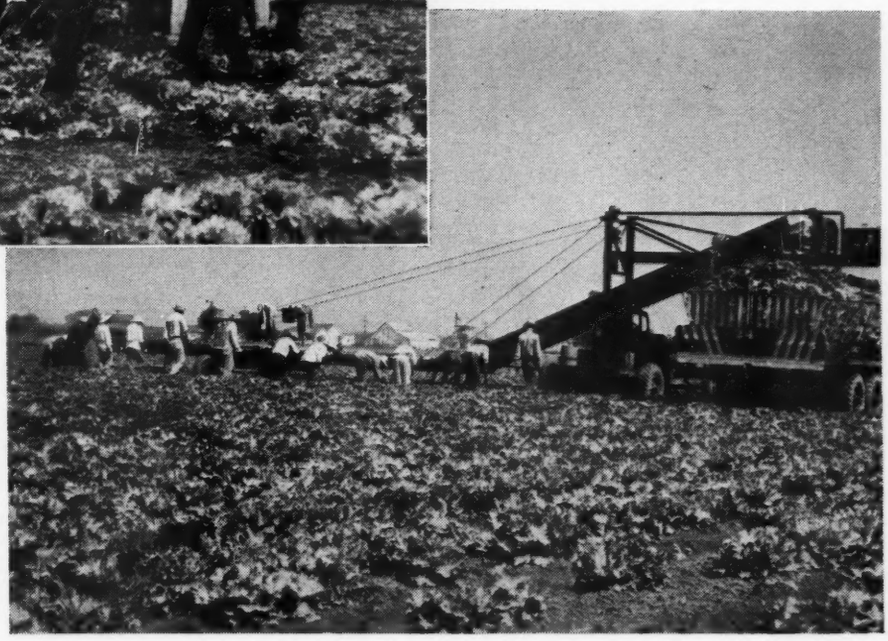


table gold mine to growers, packers, and the Southern Pacific Railroad, not to mention dealers in farm implements and fertilizers and widely scattered jobbers and retailers who distribute the health-giving food. California, according to estimates, produces 70 percent of the country's lettuce pack, with Monterey County contributing about 70 percent of the state's yield. The first shipment of 37 carloads moved from the Salinas-Watsonville area in 1921. The 1947 pack was estimated by the Agricultural Commissioner of Monterey County at nearly twelve million crates, or some 36,000 carloads, and had a cash value of more than 38 million dollars.

The lower end of the Salinas and Pajaro valleys around Watsonville does not enjoy the warm or dry climate that prevails in the sections insulated from Pacific fogs by high hills. There a gap in the Coast Range permits damp, cool air to roll in with the trade winds from Monterey Bay. Though sun bathers may shrink from it, lettuce and artichokes love it, receiving from the sea air the zest and crispness that have made them popular. This out-size truck garden lies close to two fine examples of early Spanish missions: San Juan Bautista and San Carlos. The land it occupies was once within the latter's domain which, for a long time, was the headquarters of Fra Junipero Serra—missionary, statesman, and California's pioneer agriculturist. But if the friar's thousand or more workers cultivated any salad greens, we know they were only for the tables of the mission and of the near-by presidio at Monterey.

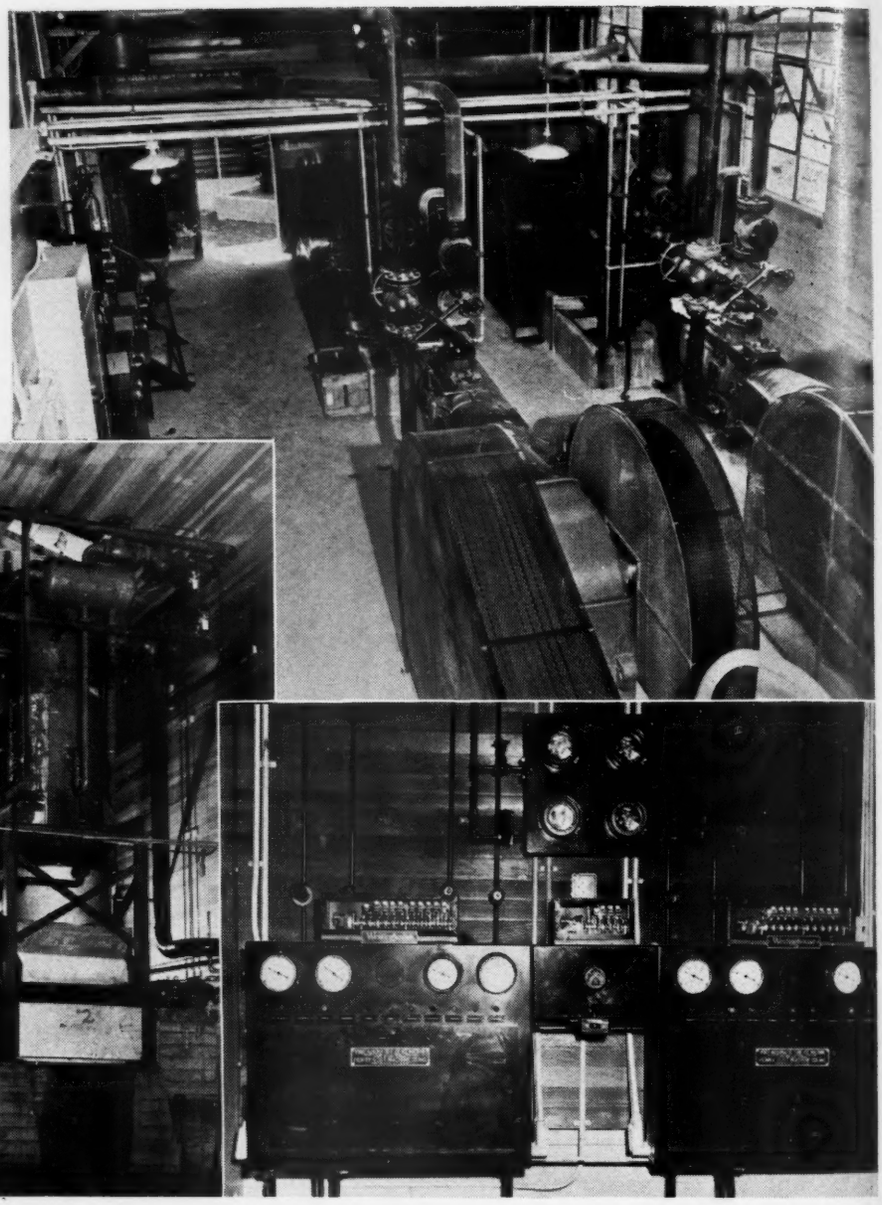
Those were the days of vitamin deficiency in the diet on Spanish ships putting in at Monterey—when an apple or, better still, a salad a day would have saved crews from scurvy. John Gilroy, first English-speaking California resident, was abandoned there when a lad of eighteen as a casualty of the dread disease. But he lived to become an American pioneer and to record much of the state's early history. Of his arrival in 1814, Gilroy wrote: "There was not a sawmill, whipsaw, or spoked wheel in California." Except for a few hides used as tallow bags, the only export was tallow, of which one cargo was sent annually in a Spanish ship to Callao, where it sold for $1.50 a hundredweight in silver, or $2 in trade. Gardens were planted around the missions, and Indians were made to grow grain to be ground into meal on crude stones; but most of the rich, level fields of the present Salad Bowl produced only pasturage for cattle.

This alluvial plain is ideally suited for irrigation, and a watertable, lying generally at depths of 150 to 250 feet, provides a reliable supply that is handled by electrically driven pumps. Much of the 50,000 to 75,000 acres, which now produce one or two crops of lettuce annually, is leased by individuals or firms that combine growing and packing, like J. J. Crosetti & Company. Mr. Crosetti entered the lettuce business 21 years ago. Then the heads were gathered in crates and packed in hand-chipped ice, methods that would soon put a man out of business today. The concern now ships 1000 to 1200 carloads annually, together with about 700 cars from a plant at El Centro in the Imperial Valley and some 500 cars of tomatoes from Watsonville.

Though an annual 40-million-dollar lettuce pack in Monterey County alone would seem to suggest easy money, growers are, in effect, gamblers against many odds such as weather, disease, pests, price, and labor supply. This year it cost them approximately $2.75 to produce a crate of lettuce. They would have been happy with that as the f.o.b. price not so long ago. Crosetti plants two crops in the Pajaro Valley, and it takes about 75 days for the lettuce to mature. Land must be graded for irrigation, and is listed on 42-inch centers into flat-topped ridges, each carrying a double row of plants. It is more or less standard practice to give the soil three separate applications of fertilizer: five tons of manure is distributed with special truck-mounted spreaders; 300 pounds of preplant commercial fertilizer is used per acre and placed about 6 inches below each twin row; and another 400 pounds is applied as side dressing to be carried to the roots by irrigating water.

TUBE-ICE PLANT

Ammonia gas compressed in four Ingersoll-Rand 100-hp. compressors (right) is expanded in four cylindrical tanks (below) each of which contains scores of vertical tubes through which water is circulated. The refrigerant gradually extracts heat from the water and freezes it from the walls inward. The ice rods thus formed are freed from the tubes by briefly circulating hot gas and warm water. As they drop from the tubes, rotary cutters reduce them to small size. The plant is automatically controlled from an instrument panel (lower right). It begins to produce ice within ten minutes after operations start and has a capacity of 235 tons in 24 hours.



Lettuce is thinned by workers with short-handled hoes when the plants are a few inches high. The crop must be irrigated about four times. It is dusted to combat thrip, aphids, and blight, while two species of cutworms keep the producers on their toes. Warm days for growing and cool nights to "marcel" the leaves are said to be fine lettuce weather. But too much cold or fog, or an unseasonable cold rain, can ruin whole fields through "slime," a form of quick decay. Seven varieties of lettuce are popular with Monterey County producers, but plant breeders still are endeavoring to perfect types that will thrive in different soils and combine quality with resistance to weather, disease, and pests.

A pack of 318 crates, or a carload per acre, is a good crop and is usually harvested in two or three pickings. All trucks and the numerous implements utilized in lettuce culture are constructed with wide (82-inch) treads to span two rows. Most striking of the many specialized devices is a traveling conveyor now used in harvesting. Turntable-mounted, it propels itself at a slow walk and delivers the hand-gathered heads into large baskets carried on a truck that moves at the same speed across the field. In harvesting for short haul by trucks, the firm employs a still more elaborate machine—virtually a packing plant on pneumatic tires—that picks, sorts, and crates the lettuce without icing.

Lettuce for shipment to distant points such as Chicago and New York is hauled to the packing plant and placed in parchment-lined crates with layers of crushed ice between courses. Conveyors carry the crates into refrigerator cars, where they are stacked four high and where pipes, served by an impeller-type blower, cover the load with a 2-foot layer of ice. It is then up to the Southern Pacific Company to see that each car's ice bunker is full; that it moves expeditiously to the Roseville Yard to join its fellows in the "Perishable Block"; and that it starts up the long Sierra grade on near passenger-train schedule toward the Midwest or Atlantic Seaboard.

Since a car requires an average of 18 tons of ice, maintaining a supply of sufficient quantity and quality is something of a problem in packing-house engineering. The general practice has been to freeze ice in brine-immersed molds and then to crush the blocks. One grower at Salinas installed a freezer in which the refrigerant is circulated in the shell of a churnlike rotating cylinder and produces slush ice that is scraped off by blades. The new plant in the Crosetti house consists essentially of four stationary, vertical freezers which, in effect, are heat exchangers each provided with numerous tubes of small diameter. The refrigerant fills the shell and surrounds the tube nest, through which water is repeatedly circulated by means of a centrifugal pump that transfers it from a catch basin under the tubes to their up-

per ends, where a distributor sprays it against their inner surfaces. Either solid tube ice of 2-inch diameter or ice with a small central hole may be produced by varying the time of the operating cycle. Crosetti uses the latter at some saving in cost and offers any excess through a subsidiary to local creameries and bars as ice never touched by human hands.

When ice of the desired thickness has accumulated on the walls of the tubes, it is loosened for gravity discharge by briefly substituting hot condenser gas for the refrigerant in the shell, a separate ammonia receiver being connected to each freezer to expedite the changeover. Removal of the ice is further speeded by circulating 14 gallons of warm water in a 20-second cycle through a thawing chamber at the base of the tubes—a method analagous to holding a refrigerator tray under a tap to free the cubes. A few seconds before the ice begins to emerge from the freezing tubes, an adjustable rotary cutter with electroplated blades is set in motion and continues to revolve until all the ice has been cut into pieces of predetermined length.

Sized ice is fed automatically to and carried by twin Link-Belt helical conveyors to a single elevating screw which, through two systems, discharges it above the 150-ton storage room. Similarly, two conveyors under grids in the storage-room floor move it to all points of use in the packing house and make car-icing deliveries on the loading dock. The plant is capable of producing 235 tons per day on a 24-hour basis and occupies but a fraction of the floor space that would be required by a conventional brine freezing installation of comparable capacity. It can be operated by one man, and begins to discharge ice in less than ten minutes after it is started. Further improvement in thermal efficiency and in transparency of the ice produced will be obtained by a treating system that is designed to remove the principal mineral content—calcium—from the well water used.

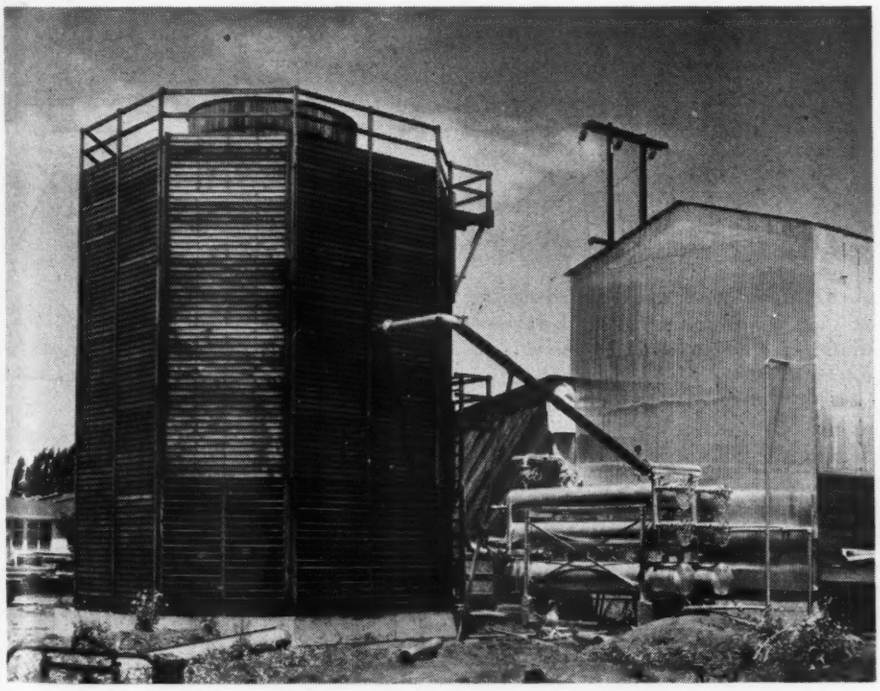
ICING CARS FOR SHIPMENT

Inside a boxcar, showing a pipe at the upper left from which ice is being blown to fill a 2-foot space above crates of lettuce. Approximately 18 tons of ice protects a carload starting across country, and more may be added from time to time before it reaches its destination.

Control of the freezing, thawing, and ice-discharge cycle is fully automatic and effected by six Alco solenoid valves with which each unit is equipped to stop and start the electric motors that drive the circulating pumps, ice cutter, and conveyors. These controls are, in turn, actuated by motor-operated cams mounted on control panels in the compressor room. A series of colored lights gives visual indication of cyclic changes in each freezer, and a set of four Mercoid switches protects against damage from mechanical failures. Timing cams are adjustable, and are now set on a 20-minute cycle so that alternate freezers discharge 1500 to 1800 pounds of ice every five minutes.

The refrigerant is compressed by four 10½x13-inch ES machines each driven through V-belt by a 100-hp., 440-volt motor. Intake pressure ranges from 20 to 30 psi., and discharge pressure from 125 to 150 psi. Cooling water for the compressors and ammonia condensers is provided by a 38-foot, octagonal, forced-draft tower built of redwood. It has a circulating capacity of 1000 gpm. and is served by a 20-hp. Motorpump. Freezers and compressors are housed in adjacent rooms, while the condensers are mounted outdoors.

The tube-ice plant was designed and manufactured by the Henry Vogt Machine Company, Inc., of Louisville, Ky., and erected by the Wareing Engineering Sales & Installation Company of Salt Lake City, Utah.



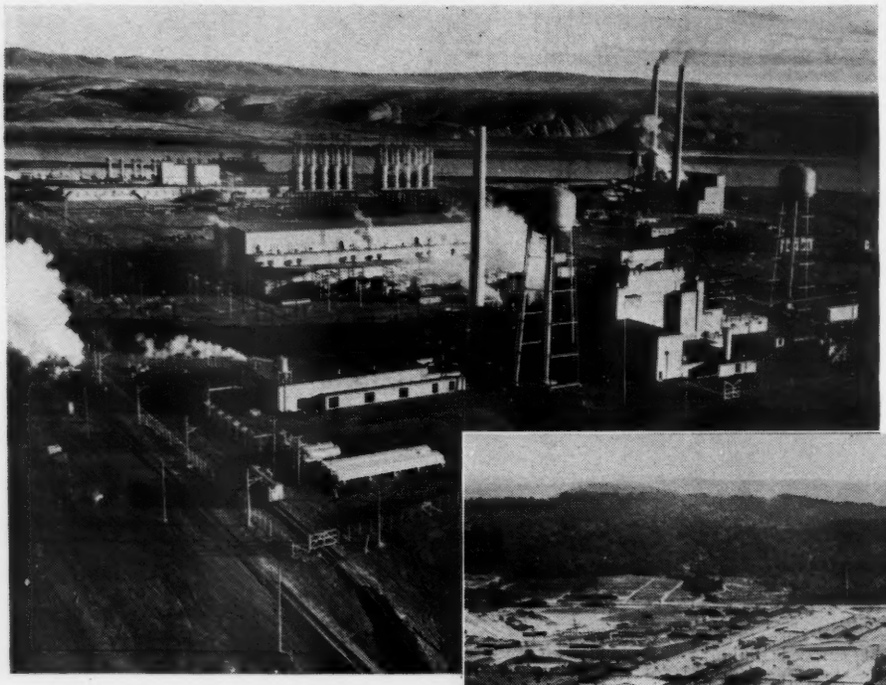
OUTDOOR REFRIGERATING AUXILIARIES

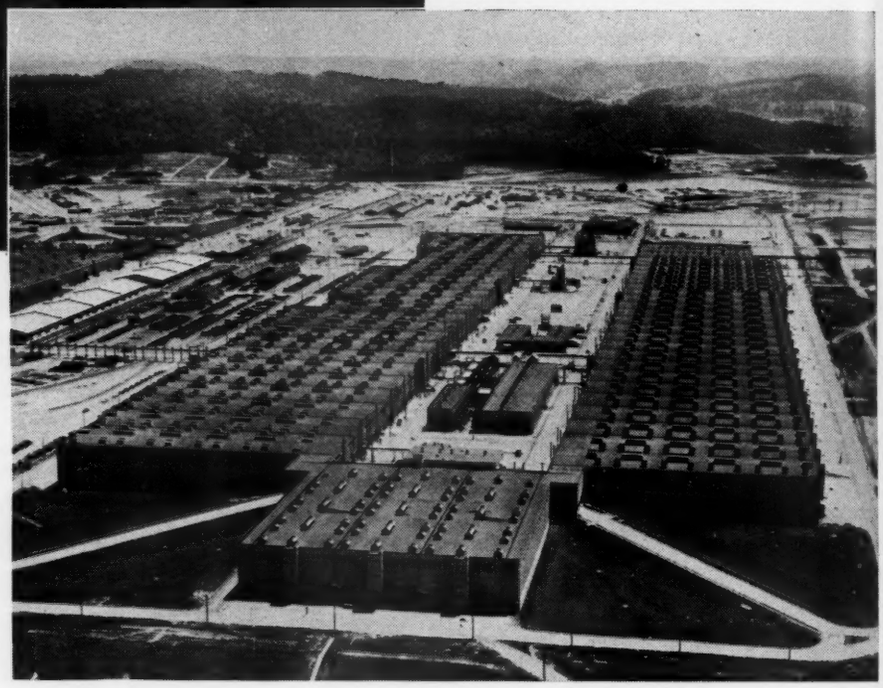
The redwood forced-draft tower of 1000-gpm. capacity in which the water is cooled that circulates through the compressor cylinder jackets and the ammonia condensers (right of tower). The packing plant is in the background.

Atomic Energy Progress

C. H. Vivian

U. S. ATOMIC ENERGY COMMISSION PHOTOS





ATOMIC-ENERGY PLANTS

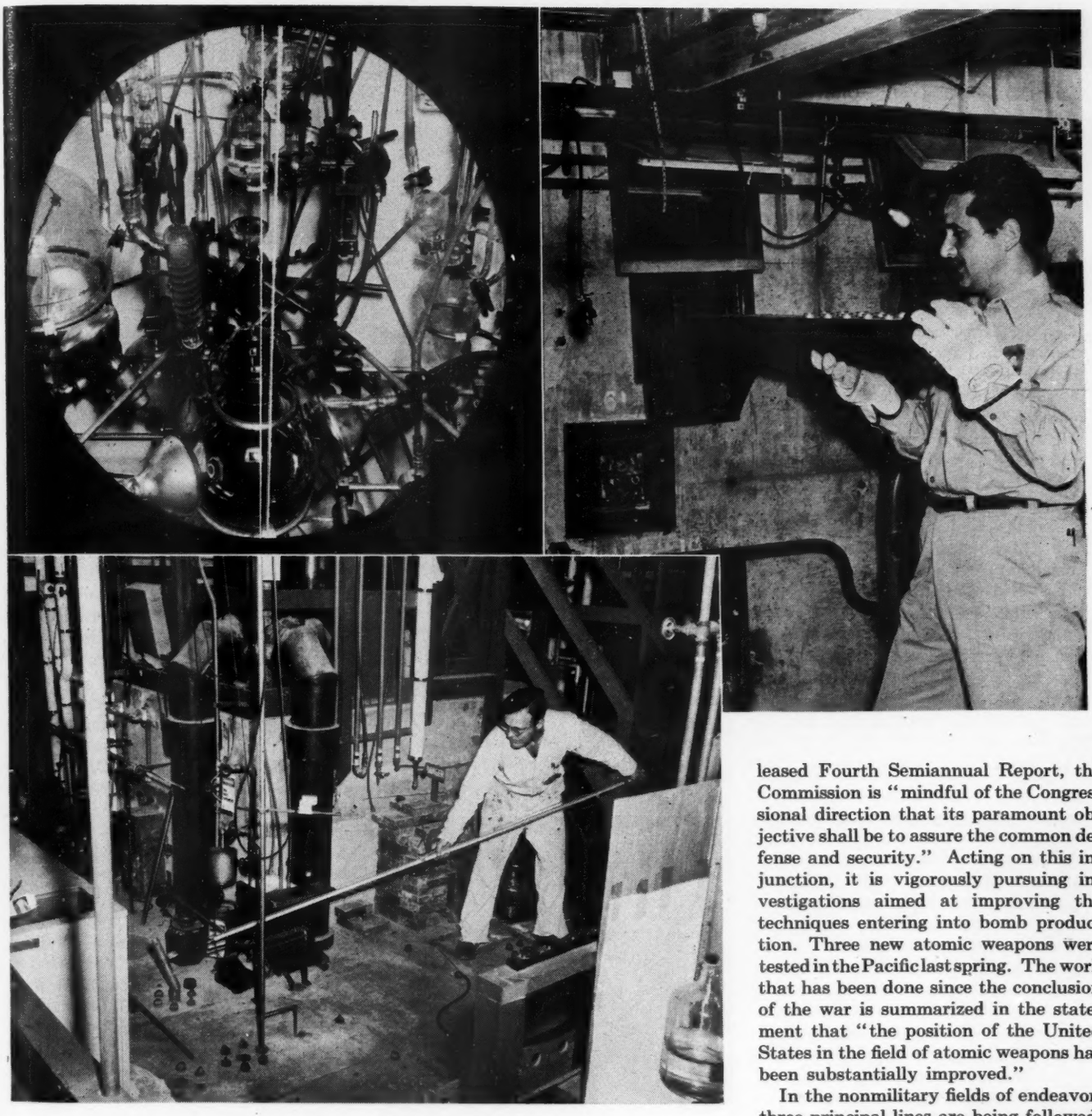
One of the key structures among the many at Oak Ridge, Tenn., is the gaseous diffusion plant (above). There the fissionable isotope of uranium, U 235, which exists in ordinary uranium, U 238, in the proportion of one part in 140 is concentrated by reducing the parent metal to a gas and passing it through a porous barrier. As the accretion of U 235 per passage is very minute, the process must be repeated thousands of times to build up the desired concentration to serve as a nuclear fuel or explosive material. Shown at the top is one of the numerous processing plants at Hanford, Wash., where the fissionable man-made element plutonium is turned out.

THE wartime atomic-energy program had just one objective: the creation of a superweapon that would quickly end the conflict. It succeeded beyond the most optimistic hopes of those who conducted it. Actually, it was one of the greatest gambles ever undertaken, and even many of those who were closest to it were amazed that the first bomb assembled behaved with such devastating effectiveness. Considering the magnitude of the undertaking and the multiplicity of its ramifications, it did not seem possible that such a gigantic jigsaw puzzle could be put together correctly at the speed with which that was done. None of the thousands of technical and production byways that converged into the final avenue leading to the bomb had been charted, and the chances for straying from the right course were multiplied beyond computation.

Scientists who directed this stupendous effort knew that nuclear energy could be turned to beneficial purposes, but they had no time then to even think about them. Their sole aim was to develop a bomb before the enemy could do so. Now that this momentous achievement is a matter of history, the enormous physical resources and the fund of knowledge that entered into making it possible are being put to service for mankind. From them, during the next decade or so, will perhaps come revelations that will overshadow in importance the creation of the bomb. They will not break forth with the electrifying suddenness that attended the sensational announcement of the destruction of Hiroshima, and they will not be cloaked in the secrecy that had theretofore prevailed. Neither will they incite fear nor hysteria, for their mission will be to safeguard human life rather than to snuff it out. Terrifying though it be, the atomic bomb has in its favor the fact that it advanced by many years the research that is calculated to bring forth the good qualities of atomic fission. Had there been no war, the facilities now available would eventually have been provided, but at a painfully slow rate.

The United States Atomic Energy Commission, which inherited the vast war-built atom-juggling machinery, has launched a broad, long-range program designed to exploit its beneficial potentialities as rapidly as possible. It is not only maintaining all the existing facilities but also adding to them enormously. For example, at Hanford, Wash., alone, there are now 15,000 men engaged in new construction. Elsewhere, also, huge developments are being carried out. There is little secrecy about them; in fact it is the aim of the Commission fully to inform the nation on what it is doing and and what it hopes to accomplish. This policy is, of course, in keeping with democratic tradition and lends emphasis to the truth that atomic energy belongs to the people.

In turning much of its attention to the peacetime applications of nuclear fission, the Commission is by no means dropping further research on the bomb. It is fully aware that other nations may at any time fathom the mysteries of this weapon and may, in fact, even arrive at simpler methods than we now have for carrying out the involved process of preparing the essential materials. Consequently, as set down in its recently re-



PRODUCING RADIOISOTOPES

The manufacture of radioisotopes of various elements for scientific, medical, agricultural, and industrial uses is one of the major peacetime activities of the atomic-energy program. The radioisotopes are employed in two ways: as sources of radiation in the treatment of disease, and as "tracers" of processes that were formerly difficult or impossible to observe. In the latter role, they have given science a new mode of perception that has boundless possibilities for ferreting out basic information on life processes. Radioisotopes have been made in small quantities and at great cost for the past fourteen years in cyclotrons and similar particle-accelerating equipment. Now the nuclear chain-reacting pile at Oak Ridge supplies them in amounts millions of times greater than was formerly possible and the Government is able to sell them at moderate rates. Three steps in preparing them are shown here. In the picture at the upper-right, chemicals in aluminum cans are being charged into the pile for irradiation. The chain reaction of the pile has been stopped so that the intense radiation will not come through the charging aperture, and as the materials themselves are not radioactive prior to treatment no shielding is necessary. The hole is plugged while the reaction is in progress, and the personnel then remains behind thick concrete walls. Those portions of the elements that have been converted into the desired pure isotopes in the pile are extracted by chemical means in "hot" laboratories. The lower view shows a technician, working rapidly with long-handled tongs, passing some radioactive material through an opening in the roof of a heavily walled concrete cubicle containing complex chemical processing apparatus. The reactions that take place there are remotely controlled from a safe distance. A photograph of the interior, taken through one of the periscopes used for observation, is reproduced at the upper left.

leased Fourth Semiannual Report, the Commission is "mindful of the Congressional direction that its paramount objective shall be to assure the common defense and security." Acting on this injunction, it is vigorously pursuing investigations aimed at improving the techniques entering into bomb production. Three new atomic weapons were tested in the Pacific last spring. The work that has been done since the conclusion of the war is summarized in the statement that "the position of the United States in the field of atomic weapons has been substantially improved."

In the nonmilitary fields of endeavor, three principal lines are being followed. The first of these is the making and distribution of isotopes of most of the known 96 chemical elements that make up the universe. This program is being pushed because it lends itself to immediate development. The second great promise of applying atomic energy gainfully relates to its use for generating industrial power. The groundwork for the structure by which its possibilities in this department are to be determined is being laid, but it is freely admitted that a decade or more of research will be needed to prove or disprove its practicability. The third line of investigation is in the realm of pure science and involves probing more deeply into the secrets of the atom. From these studies will undoubtedly come additional knowledge that can be turned to worth-while pur-

poses, some of which are now unknown.

Isotopes produced at Oak Ridge, Tenn., are already being used in more than 300 laboratories and hospitals in this country and abroad to increase man's understanding of himself and the world he lives in. Numerous ways of applying them in the scientific, medical, agricultural, and industrial fields are already known, and others are continually suggesting themselves. Isotopes are currently assisting science in two ways: as sources of radiation primarily for treating disease and as "tracers" of processes that have previously been difficult or impossible to observe. In the latter role, they are being acclaimed as the most useful research tool to appear since the microscope was invented in the Seventeenth century.

The 96 known elements have more than 800 isotopes, some stable and some radioactive. Many of these exist in nature, while others have to be created. Different isotopes of a given element are identical chemically but have distinctive nuclear properties. Consequently, they can serve as identifying media for "tagging" materials entering into plant and animal growth and industrial processes. As an example, carbon, an important constituent of food and also of the large family of "hydrocarbons" that includes coal, petroleum, and natural gas, has five isotopes. Two of them, C 12 and C 13, occur in nature in the proportion of 99 to 1. By increasing the ratio of C 13 through enrichment, the scientist obtains a "tracer" that can be spotted readily wherever it may appear. This makes it possible, for the first time, to follow in detail the workings of fundamental natural and man-directed processes. Foremost among these is photosynthesis, in which plants convert energy from the sun into such carbon-containing substances as sugar, starch, and cellulose; metabolism, in which the human body utilizes some of these compounds, taken in as food, to provide the living cells with the sun's energy; and the processing of hydrocarbons into manifold materials, of which gasoline is one.

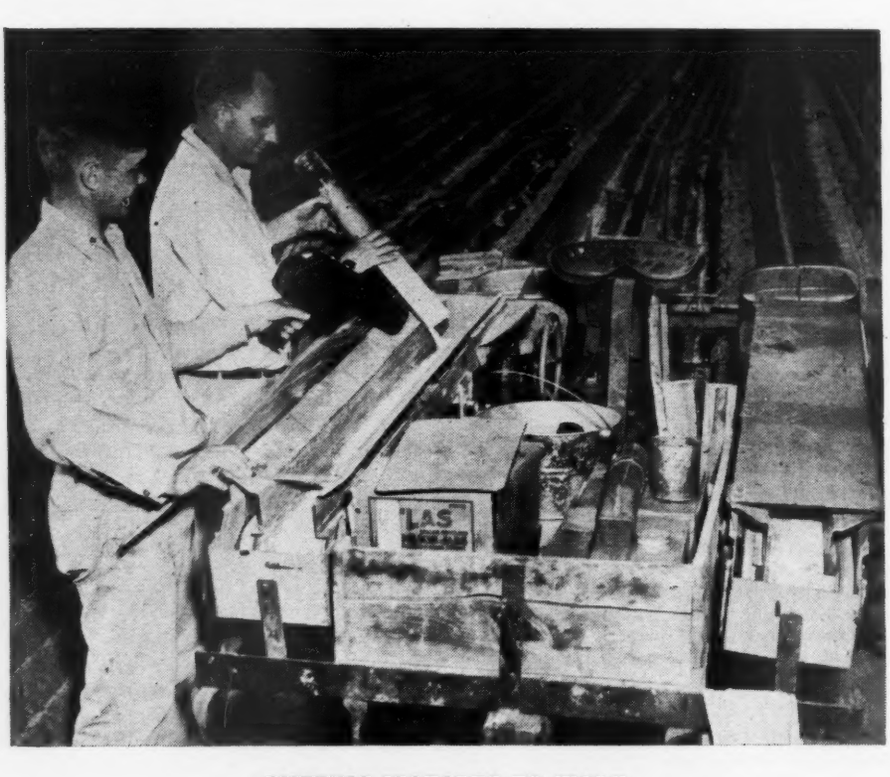
The new arm of science known as tracer research has, to quote the Commission's report, "already broadened our understanding of these and many other fundamental processes. Already, medical men are profiting from a better understanding of the workings of the human body. For the future, it is difficult to forecast the gains that isotopes will bring. They will speed the battle against disease. They will help man to make more efficient use of nature's materials, to grow more food, to produce better manufactured goods—in short, to adopt his environment to his needs."

Heretofore scientists have been hampered by the difficulties and expense of concentrating stable isotopes and creating their radioactive brothers called radioisotopes. In many cases these were available only in quantities so small that they could not be seen by the unaided eye. In contrast, the war-born chain-reacting nuclear pile produces them in amounts millions of times greater than is possible with particle accelerators such as the cyclotron. As a result, they are being made available to qualified users in ample amounts and at small cost. Up to now, 236 laboratories in our universities, research institutions, hospitals, and industrial concerns have been equipped to handle them, and more are being outfitted as fast as competent scientists and technicians become available to staff them. To meet the latter need, many educational institutions have established courses designed to turn out trained workers. All told, isotopes have been furnished for more than 1000 research projects.

Of special interest to many of our readers are the industrial applications of isotopes. Among current investigations in the petroleum field, the Shell Oil Company and the California Research Corporation are employing radioactive carbon as a tracer to follow through the changes that crude oil undergoes in the cracking process. The Texas Company is using it to study proposed methods of making synthetic gasoline from coal and natural gas. In the rubber industry, the Goodyear Tire & Rubber Company is utilizing a radioisotope of sulphur to help fathom the mysteries of the vulcanization and polymerization processes. Numerous research laboratories are conducting tracer investigations in the field of metallurgy with a view to learning more about the structure, manufacture, alloying properties, durability, corrosion, and friction qualities of metals.

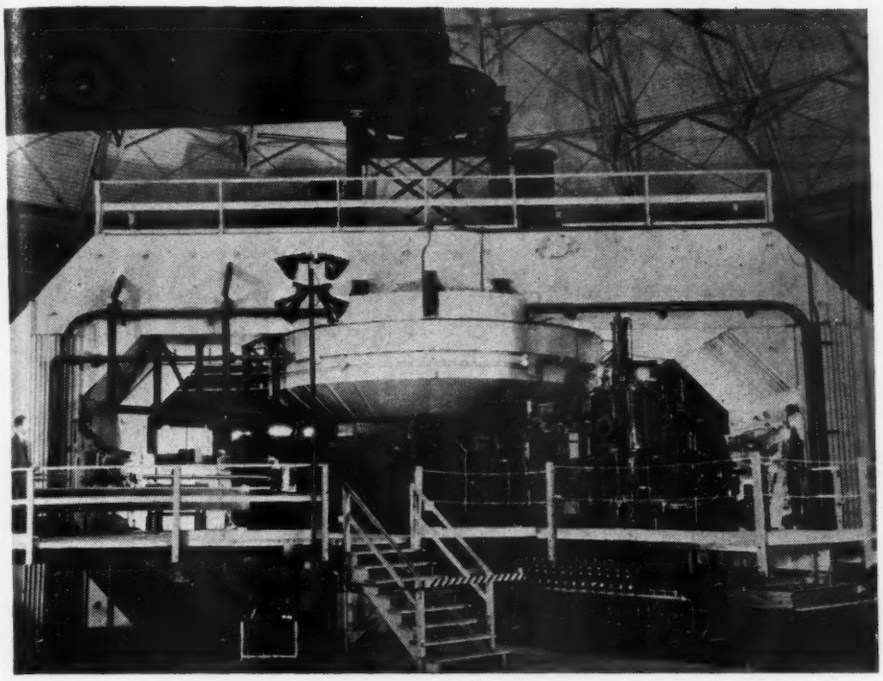
Research in power production from atomic energy is still in a preliminary stage. The large nuclear reactors at Hanford and a smaller one at Oak Ridge now generate huge quantities of heat, but not in usable form. In the first case, it merely warms the Columbia River; in the second, it is dissipated in the air. Uppermost among the problems to be solved is that of finding materials for reactors and other apparatus that will withstand the high temperatures and the high levels of radiation from the fissionable elements responsible for the heat. The widespread use of atomic power, the Commission reports, will also depend upon the availability of nuclear fuels: uranium 235, uranium 233, and plutonium 239. As all come from ordinary uranium or thorium, the extent to which the latter two are found will be a controlling factor.

"In anticipation of a rapidly growing shortage of uranium," the Commission states, "great attention has been given to 'breeding,' a process in which plutonium or uranium 233 is produced by the



PUTTING ISOTOPES TO WORK

Fertilizer that has been "tagged" with a radioisotope is shown being loaded on the endless belt of a machine that will distribute it over a field. The scientist at the left is checking the radiation hazard with a safety meter. The radioactive material serves as a tracer that will permit following the course of the fertilizer through the growing plants and thus reveal important information on how and in what quantities the elements it contains enter into the growing process.



CYCLOTRON AT UNIVERSITY OF CALIFORNIA

In this giant atom-smasher, which is operated with Atomic Energy Commission funds, scientists last February produced for the first time high-energy atom particles known as mesons, which had previously been observed only in cosmic rays. Since the meson may be the key to determining what gives atoms the binding force that makes them so hard to split, the achievement at Berkeley is regarded by many nuclear physicists as the most important advance since the discovery of uranium fission in the 1930's.

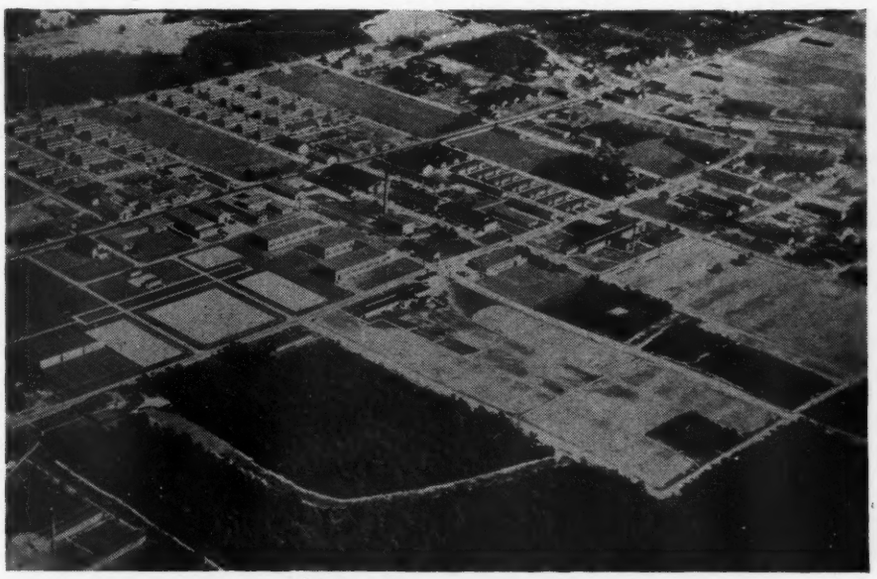
power reactor at a rate greater than its consumption. It is theoretically possible —but in practice will be very difficult— to build an industrial reactor that will cause excess neutrons to be absorbed in a blanket of either U 238 or thorium, producing plutonium or U 233 which can serve as new fuel to continue the operation indefinitely as long as new natural uranium or thorium is supplied. This greatly increases the availability of fuel, for most of the uranium, not just the small 235 fraction of it, is consumable, and moreover, the larger resources of thorium can be used. Nevertheless, the engineering difficulties associated with breeding are enormous."

At prewar costs uranium would compete with coal under almost any conditions. However, there are only limited known deposits of the fairly rich ore that was then being mined. Barring the discovery of additional high-grade material, large-scale use of uranium will necessitate mining progressively leaner deposits, with the attendant high cost of handling great quantities of rock. It is a reasonable assumption, then, that the cost of uranium will increase.

In that event and in the absence of a satisfactory solution of the technical problems of breeding, the Commission doubts that atomic power could compete with coal power in the United States except in regions where the cost of transporting the latter fuel is very high, or where other special conditions prevail. On the other hand, with a favorable uranium price and establishment of a breeding technique, the Commission states that atomic power plants might ultimately exceed coal plants in capacity. It concludes with the remark that present knowledge of future eventualities does not permit a definite prediction.

It is a fact, however, that a nuclear-fuel power plant will cost more to build than one of like capacity for burning coal. The Commission has authorized the construction of two reactors that should produce atomic power, but not economically. They will serve as guinea pigs, and from them and others to follow may come the answer to the problems that now seem to stand in the way of embarking soon on an era of nuclear power.

In addition to the activities mentioned, the Commission has commissioned the building of three particle accelerators of various types and has planned ten others. Seven of 50-odd high-energy units now operating in this country are under the Commission's direction. Many basic facts regarding the constitution of matter are expected to come from these atom-smashers. This year one of them, at the University of California, produced mesons artificially for the first time. A meson, also called a mesotron, is a high-energy particle that plays an important part in nuclear processes. Previously it had been observed only in cosmic rays. Further study of it in the higher-power particle accelerators now building and projected may yield information on the forces that hold the nucleus of the atom together. Besides divulging facts about the character and behavior of atoms, these accelerators produce isotopes that are not obtainable from atomic piles and that are essential to the investigation of a number of problems, among them the effect of radiation on living things.

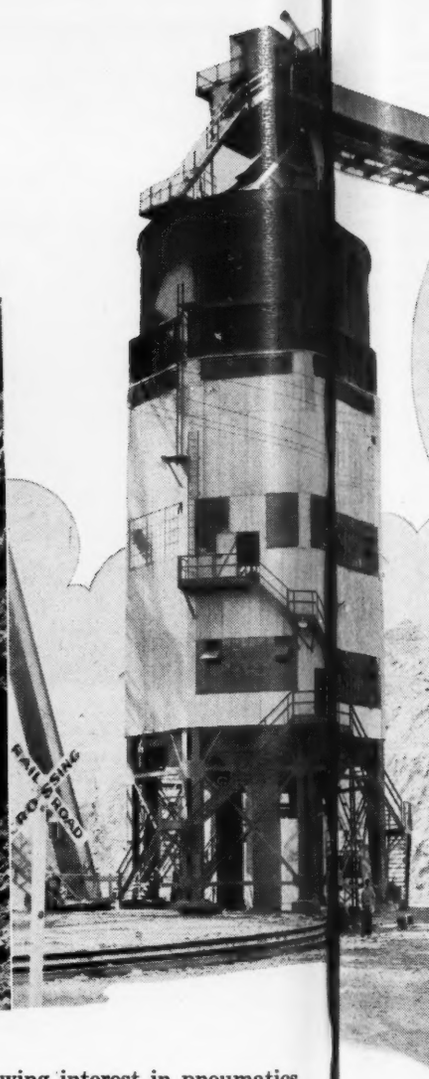


BROOKHAVEN NATIONAL LABORATORY

This establishment on Long Island, New York, is being built up to serve as a center of nuclear research for the large universities in the East. Additions to its present facilities will include an experimental nuclear reactor and a 30-foot-radius proton-synchrotron. The latter will cost about $3,000,000 and require three years to construct. Its track for accelerating protons will have almost four times the radius of the existing University of California cyclotron, and the machine will develop energies seven times as great as the one at Berkeley.

Pneumatics or Hydraulics?

E. L. Holbrook



BRAKING FORCE TRANSMITTED AT HIGH SPEED

The most familiar and widespread example of pneumatic control is the braking of trains. Compressed-air impulses, traveling through piping at almost the speed of sound, will apply all the brakes on a freight train 1½ miles long in a little more than eight seconds.

IN THE past few years, pneumatic controls have entered the marine, industrial, and aviation industries, and the hydraulic type now finds itself on the defensive in certain fields. Hydraulics has done and still does an excellent job, but has enjoyed certain usage only because no better means offered real competition until the advent of pneumatic controls.

Actually, this means of transmitting power or motion is not new. Even before the adoption of brakes around 1869, air-operated tools had been in use for a few years. The past 75 years of railroad service have proved the worth of this type of control because pneumatic-braking equipment has been and is exposed to widely varying conditions. No other appliance in the art of transportation is subjected to so many variables, namely: Difference in weight of empty cars and in capacity and size; complexity of handling long trains both on level stretches and in mountain or grade operation; high speeds of passenger trains; grouping of empty and loaded cars; extreme variations in temperature seasonally or en route; and difference in operation and maintenance in accordance with individual views and skill.

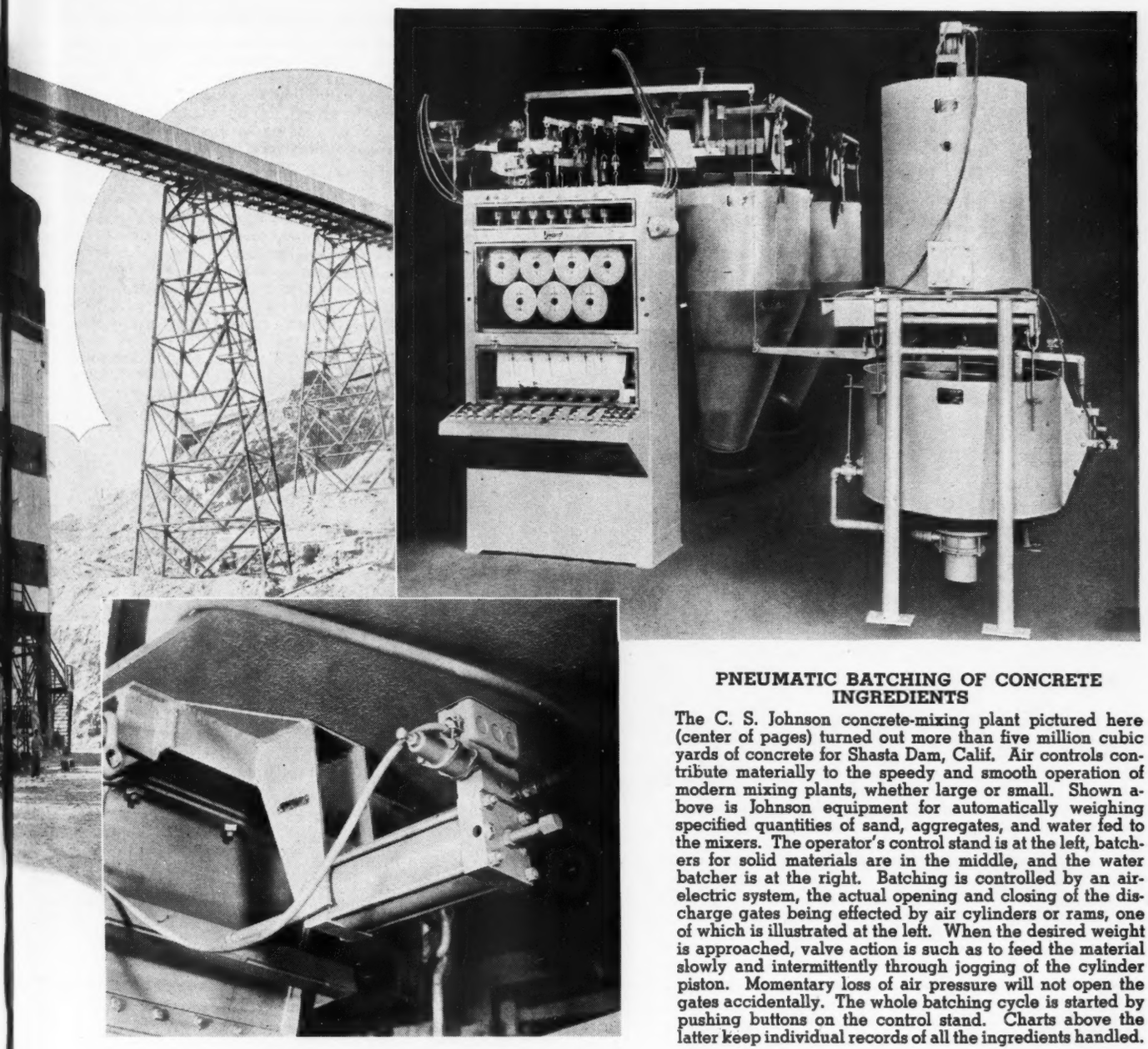
Ways and means have been provided for accelerating the flow of air over long distances until it is just short of the speed of sound; that is, 1080 feet per second. An emergency brake application races from one end of a 150-car freight train to the other faster than a man can run the length of four: 650 miles an hour—950 feet per second—by pure pneumatics.

The use of hydraulics for brakes, clutches, throttles, miscellaneous movements, etc., was a big step forward because it eliminated cumbersome levers, cranks, chains, etc. Certainly, the transmission of power and motion through a flexible medium did much to simplify the installation of control centers and to give operators better working stations. Being noncompressible, a liquid fluid still is of advantage in many applications, and its industrial use will therefore not be appreciably jeopardized by the growing interest in pneumatics.

However, in many instances, pneumatics will insure greater flexibility and therefore replace some poorly applied hydraulic equipment. It will also offer a solution in many cases where work has heretofore been left undone or handled in some awkward manner. Frequently, the advantages of both systems can be combined to do a neater job and to eliminate difficulties. For example, compressed-air lines can readily be substituted for long hydraulic lines, leaving the heavy hydraulic equipment to operate at the point where its service is required. Leakage, temperature changes, air pockets, etc., in liquid lines, can then be controlled and headaches avoided. Pneumatics might well be considered the "aspirin" of industry.

To clarify, let us scan some of the decided advantages a pneumatic system has in its favor:

Elimination of fire hazard
Saving in weight
Superior performance at low temperatures
Not as vulnerable as hydraulics
Cleanliness
Facility for interlocking functions—safety
More flexible in operation than hydraulics
Large amounts of stored energy
Combines easily with other means of control



PNEUMATIC BATCHING OF CONCRETE INGREDIENTS

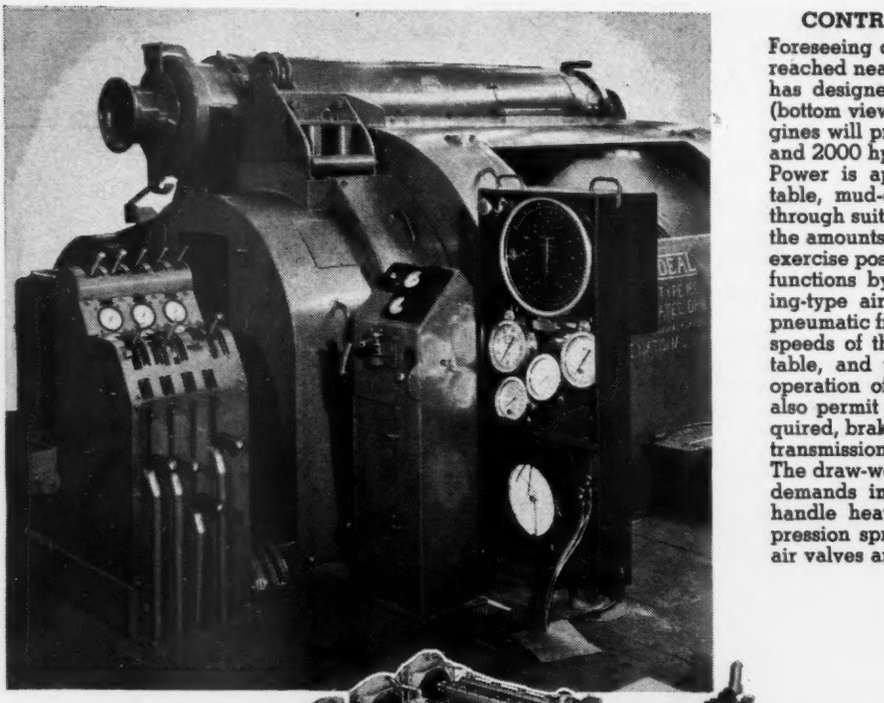
The C. S. Johnson concrete-mixing plant pictured here (center of pages) turned out more than five million cubic yards of concrete for Shasta Dam, Calif. Air controls contribute materially to the speedy and smooth operation of modern mixing plants, whether large or small. Shown above is Johnson equipment for automatically weighing specified quantities of sand, aggregates, and water fed to the mixers. The operator's control stand is at the left, batchers for solid materials are in the middle, and the water batcher is at the right. Batching is controlled by an air-electric system, the actual opening and closing of the discharge gates being effected by air cylinders or rams, one of which is illustrated at the left. When the desired weight is approached, valve action is such as to feed the material slowly and intermittently through jogging of the cylinder piston. Momentary loss of air pressure will not open the gates accidentally. The whole batching cycle is started by pushing buttons on the control stand. Charts above the latter keep individual records of all the ingredients handled.

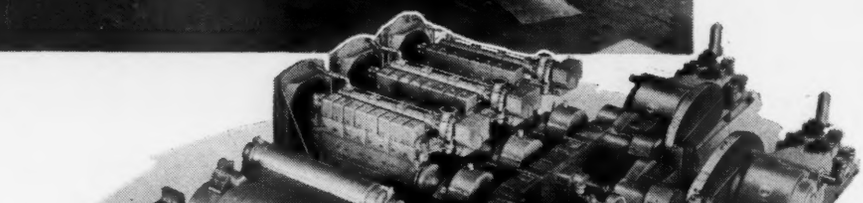
Little need be said about the risk of fire because air leaks are not combustible. A broken line does little more than cause a loss in air pressure which, obviously, does not spew an inflammable liquid over heated engines, machinery, brakes, etc. Far too many of our combat planes were lost in World War II because of control-fluid fires. It is a well-known fact that the hydraulic industry is searching for a noncombustible liquid, but so far its findings have been costly and difficulties have been encountered in providing a good control medium possessing all the other requisites.

In the matter of weight saving, a great deal is accomplished because of the difference in the size of supply lines. Air can be transmitted at a high rate of speed through small-diameter tubing and yet deliver its pounds-per-square-inch force. It is true that compressed air encounters friction in traveling through long, constricted piping, but that retarding effect is much less than it is with a liquid medium. Too, the use of relay valves and of quick-application and quick-release valves helps to offset this action; and the long tubing can be made to serve as a pilot line, with the quick application of pressure right at the job.

Air weighs much less than other fluids, and that helps materially to compensate for the greater weight of a compressor as compared with a hydraulic pump. Structural parts of the machine or its supports often can be used as air reservoirs, thereby saving weight and making it possible to store energy close to the working point. There are numerous hydraulic applications that require delivery and return lines for satisfactory operation. Pneumatic systems, on the other hand, can in most cases be actuated by the aid of but a single line extending from the control valve to the power device, the air being both admitted and exhausted through the one pipe by the control valve.

Compressed air, if properly dried, performs much better under extreme weather and temperature conditions than a hydraulic fluid. At very low temperatures the latter is sluggish, whereas air's power to operate remains more nearly constant throughout the range machinery now normally encounters. Probably the most extreme conditions are found on aircraft, which may go from tropical ground heat to sub-zero in high-altitude flying. Not only is movement a factor under such circumstances, but the maintenance of force or position likewise has to be reckoned with. A quick increase in temperature causes fluid to expand, and, conversely, a rapid decrease results in contraction of the fluid column. Such a rise or drop, which also affects air, can be controlled in





CONTROLLING DEEP-WELL DRILLING RIG

Foreseeing oil wells 20,000 feet deep (some have already reached nearly 18,000 feet), the National Supply Company has designed its new Ideal Type 160 rotary drilling rig (bottom view) to handle 400-ton loads. Its three diesel engines will provide up to 1860 hp. for continuous operation and 2000 hp. for hoisting under maximum load conditions. Power is applied selectively to the draw works, rotary table, mud-circulating pumps, and catheads (capstans) through suitable chain transmission, shafts, and clutches in the amounts needed. From his station (left), the driller can exercise positive and almost effortless control of the various functions by manipulating pneumatic devices. Modulating-type air valves enable him to apply power through pneumatic friction clutches so as to select any one of the six speeds of the draw-works drum, six speeds of the rotary table, and three speeds of the catshaft, with individual operation of the two catheads. Valves of the same type also permit controlling the engine throttles as may be required, brakes on the draw-works drum, the 3-speed engine transmission, and the rotary-table drive transmission. The draw-works brake was designed especially to meet the demands imposed by the 1½ inch wire cable used to handle heavy loads. Braking force is applied by compression springs and released by compressed air. Other air valves are convenient to the equipment they control.

pneumatic systems by valves. These maintain well-nigh constant pressure by releasing any excess pressure caused by expansion or by replenishing any loss due to contraction. The result is a steady force in the receiver or position of the controlled device.

A pneumatic system is not likely to be as vulnerable as a hydraulic one by reason of the smaller and oft-times fewer lines involved. Although this may not seem to be of importance in peacetime, it is a vital factor on combat ships and aircraft, in front-line shops, etc. Representing, as it does, a smaller target, there is less chance of a hit by shrapnel fire, proximity shells, etc.

A damaged or leaking line in a good pneumatic control system does not necessarily make it useless, for the air-

Pneumatic Controls on Power Shovels

WHEN power shovels were operated by steam, separate engines were used to supply power for each of the three motions—hoisting, crowding, and swinging. When gasoline and diesel engines were introduced, it was no longer practicable to utilize individual engines for all these purposes, so clutches were developed to pick up the respective loads from a single power plant. Operators manipulating these clutches by hand tired quickly, and it was soon recognized that a machine would do more work if power control were available for both clutches and brakes. Such control could be operated by air pressure, hydraulic pressure, or vacuum. After analyzing the advantages and drawbacks of all three, The Osgood Company adopted compressed air for reasons that have been set forth in the company's literature by Fred L. White, chief engineer.

He points out that while vacuum is easily induced by either a pump or the engine manifold it provides low pressure, which requires extremely large cylinders to produce an effective operating force. Furthermore, a slight leak anywhere in the system reduces the efficiency rapidly.

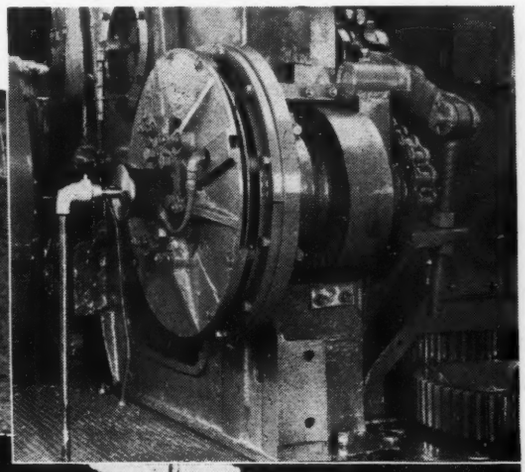
High pressure and, consequently, small cylinders, can be used in a hydraulic system, but as no satisfactory way of varying the pressure has been devised, the action is sometimes too quick and harsh. In the event of even a slight leak the fluid soon escapes and covers surrounding parts. The probability of leaks occurring is increased by the high pressures applied. If one does develop, further operation of the shovel is impossible until it is repaired.

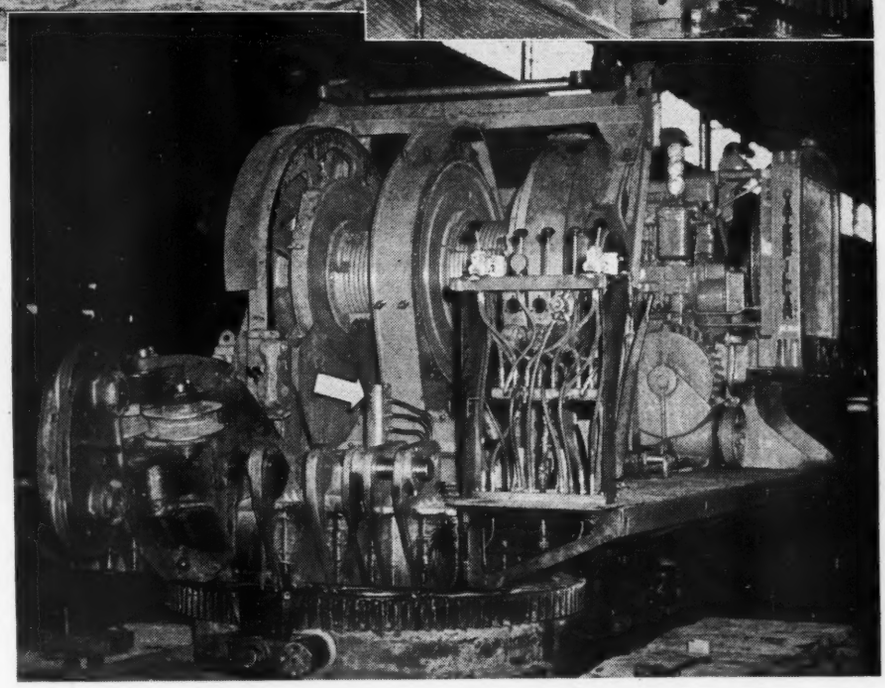
Compressed air does not have these disadvantages. Its expansive properties permit the use of metering valves that vary the pressure in accordance with the amount of air admitted. A leak, unless of major size, will not necessitate stopping the machine for repairs, will create no muss, and will not call for replacement of expensive fluid. Cylinders of moderate size are permissible with pressures up to 100 psi., but that maximum is still so much less than normal hydraulic pressure that the chance of line breakage is reduced. Further, lower pressure and means of varying that pressure enable the operator to control the motions with precision. In addition to easing his job, air controls simplify manufacture and maintenance by eliminating lever connections and linkages needed for manual operation. Fewer parts are required, there are fewer points to be lubricated, and lost motion through linkage wear is obviated.

All motions of Osgood machines are air controlled. Swing and travel friction clutches are of the air-cushion type in which the working element is a rubber tube that expands when air is introduced to engage a fixed and a movable plate. Other clutches are of the outside-band type, and each is engaged by a single-

acting pneumatic cylinder and released by spring action. Steering is effected by an air cylinder that disengages the travel jaw clutch and sets a brake band to lock the crawler on either side, as desired. When the air is cut off, a spring engages the clutch and releases the brake. Single-acting pneumatic cylinders, controlled through metering valves operated by linkages in the brake-pedal connections, act as boosters for the hoist and crowd brakes. If the air supply should fail, the brakes can be applied manually.

Air is compressed by a 2-cylinder, single-stage compressor driven by belt from the main engine and discharges into a receiver. Traps are provided to remove moisture from the air and thus to prevent freezing during cold weather. Control levers are mounted on a panel in front of the operator. Air lines from the compressor to the receiver and to the control station are iron pipes, while those from the control panel to the various working points are of copper to eliminate joints and to reduce the likelihood of leaks. Air is delivered at 100 psi. pressure, which is available when valves are fully open. Swing and hoist clutches usually operate at from 40 to 60 psi., and the maximum pressure is seldom used except for traveling.





control valve, as previously explained, will continually compensate for loss through leakage up to its full capacity. This permits of emergency operation until repairs have been made. Cut-off valves can be provided in many cases to localize an inoperative section in the event of a complete break, thus allowing the remainder of the system to function normally and to give safe though limited service until everything is again in order.

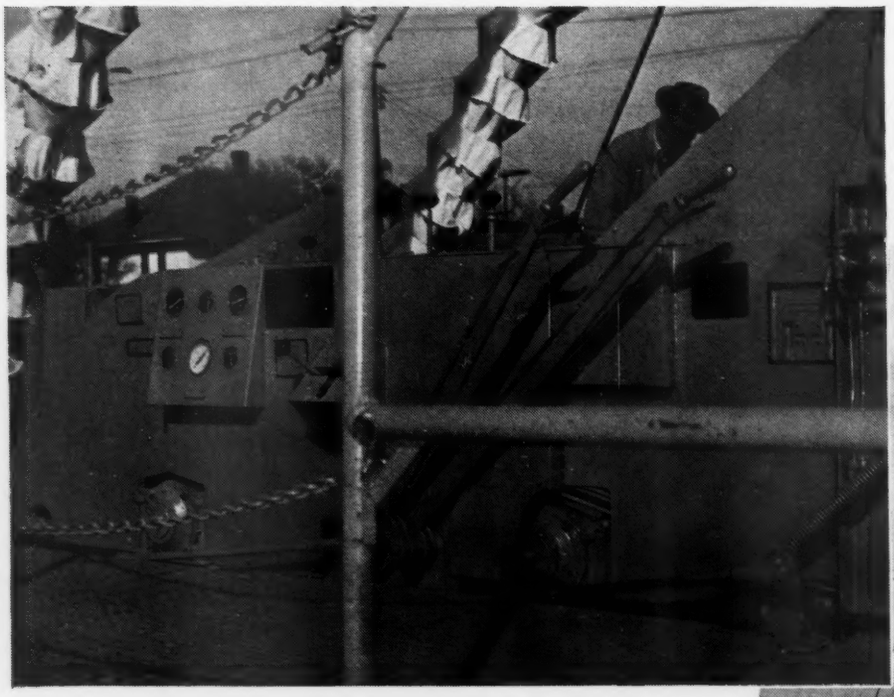
However, if such a loss in pressure at some points would damage a machine considerably through continued operation, emergency valves could be used to apply a hold or brake, or to cut off power either to parts of or to the entire machine until full pressure had been restored. This, obviously, depends upon the type of equipment involved, the circumstances encountered, and the relative values under consideration. Even if the resultant damage were great, it would be the first consideration of the pilot of a large passenger plane, for instance, to bring it safely to earth.

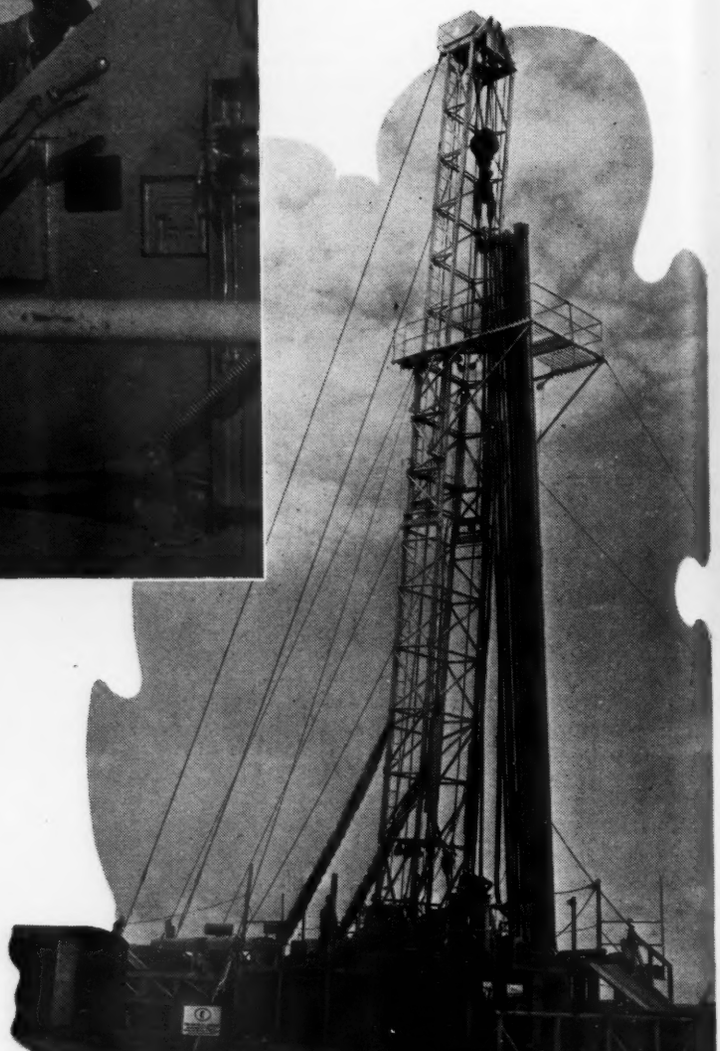
Loss of air is of little consequence because it is at all times available. The mere replacement or reconnection of lines is sufficient to resume operation and does not call for the reintroduction of the power medium in the manner well known throughout the hydraulic field. Such resetting of equipment as is required when filling lines with a liquid is tedious and there is the ever-present danger of air locks because of bends, fittings, etc.

Line breakage or leakage leads us to

POWER-SHOVEL AIR CONTROLS

Pictured at the top-left is one of four types of Osgood power shovels that are equipped with pneumatic controls and that utilize air-cushion clutches. The operator's control panel is assembled as a unit and then mounted on the machine. The levers all have a short throw and work metering valves that admit compressed air to the lines extending to the various mechanisms. The amount of pressure brought to bear depends upon the distance the lever is moved. The view above shows a control panel (center of machine) mounted on a dragline superstructure. An arrow indicates a rotary coupling, a patented Osgood device that allows compressed air to be carried below the deck through the center shaft to the clutches and brakes in the crawler mechanism. Without it, air would be available on only the upper deck of the shovel. Another Osgood feature, the air-cushion clutch which eliminates the need of small cams and rollers, is illustrated at the top-right. A circular rubber tube or "doughnut" is confined between two plates, one of which is movable and the other stationary. The admission of air inflates the tube and engages the clutch plates. The operator, at will, can vary the volume of air admitted and therefore pick up the load as slowly or as quickly as he desires. However, the amount of air required is so great that it is impossible to admit it fast enough to cause the machine to jerk. When the air is exhausted from the tube, the clutch is disengaged by the action of springs.





CARDWELL TRAILERIG

Recently introduced by the Cardwell Manufacturing Company of Wichita, Kans., this portable oil-well drilling outfit is the largest thus far developed. Capable of drilling to a depth of 5000 feet, it is so compact that, with its mast folded and telescoped, the unit is only 8 feet wide, 13½ feet high, and 59 feet long, and can readily travel the highways. Power supplied by two Waukesha engines is applied to the various mechanisms through pneumatic clutches. Each clutch consists of plates that are engaged by exerting pressure on a Neoprene diaphragm that extends across their full diameter. The clutches function best with 80 psi. pressure, and a valve prevents air from reaching them if its pressure is below 65 psi. The clutches are controlled from the operator's station by moving the knob-tipped levers shown above. These serve to actuate Westinghouse valves interposed in the compressed-air lines. Pneumatic control not only eliminates tiring manual effort but also insures complete and positive application of the clutch pressures required to handle the heavy loads encountered in drilling. The view at the right shows a Trailerig with the mast extended to a height of 90 feet, and drilling at a depth of 3700 feet at Newcastle, Wyo.

the next item on the list. Pneumatic equipment is much cleaner than hydraulic machinery because an air leak does not spread unsightly oil over either the interior or exterior of a machine. Better designing of airplanes, for example, has removed the engine-oil hazard and relieved the pilot and crew of the troubles they once had from this source. However, no sooner was that accomplished, than the risk was reintroduced by running hydraulic control lines throughout the interior of the craft. Pneumatics can continue to operate with measurable leakage without fear of unsightly messes, fire hazard, or endangering limb and life by slippery footings, etc. Its use would certainly cut down maintenance work and inspection. Air leaks in a high-pressure system, if of such a magnitude as to warrant attention, are easily located.

Interlocking and sequencing of pneumatic functions present no serious problem and insure positive, reliable performance. Relay valves, double check valves, cylinder porting, quick-application and quick-release valves, etc., can be interposed in air lines to do first things first—to delay action, to time movement, and to carry out the operations of complicated jobs in proper sequence. All this makes for safety of life and property and insures against failure that is apt to occur when the human element is depended upon. Pneumatic controls cannot fall asleep, go out the night before, or get excited during an emergency.

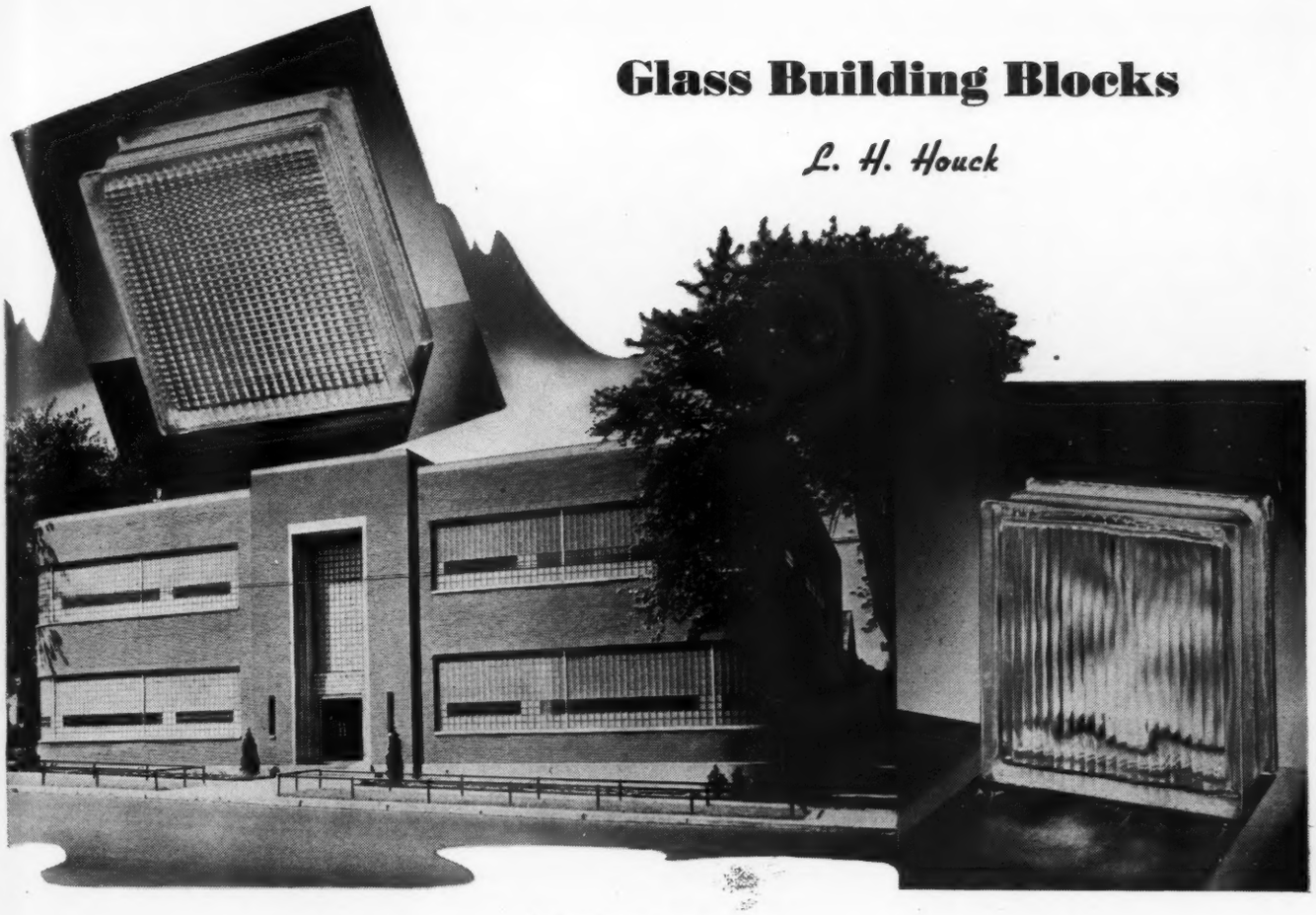
Many of our naval and Coast Guard vessels were equipped with systems of this kind to operate the propulsion machinery from the pilot house or bridge. Often, during protracted maneuvers, inexperienced men were put in charge of the engines, but damage that might have resulted from improper operation was prevented by the interlocking controls. The men could not make a wrong move. Complete reversal of large diesels was accomplished by a single handle control that defied error!

Pneumatic systems, as has already been emphasized, are extremely flexible. They can be built to perform many kinds of work and, through control by the correct association of valves and cylinders, to vary loads at different speeds throughout the working range. Movable control stations can be provided to enable operators to keep close watch on clearances, machinery movements, etc. Such a system readily lends itself to the storage of large amounts of energy for immediate use. The compressor can therefore charge at leisure a sufficient volume of air for a sudden application of power either as a regular function or in an emergency. Consequently, a machine of moderate horsepower will often accomplish as much as a larger compressor.

It all adds up to one thing. There will be more pneumatics in our future!

Glass Building Blocks

L. H. Houck



STRUCTURAL GLASS

These pictures show two standard patterns of glass blocks and a building in which they are used with pleasing architectural effect. In addition to admitting ample daylight, they are resistant to a wide range of temperatures or varied climates. Their partially evacuated interior makes them good insulators against heat and cold.

WHEN the ancient Phoenicians puddled silica, potash, and soda over a fire and produced the first glass some 4000 years ago they made a definite contribution toward bringing mankind out of darkness. Today, in the hands of competent architects and designers, glass blocks are adding beauty and light to ultramodern structures. In addition, they have many utilitarian applications. In this conveniently usable form, glass is both a structural and an insulating material.

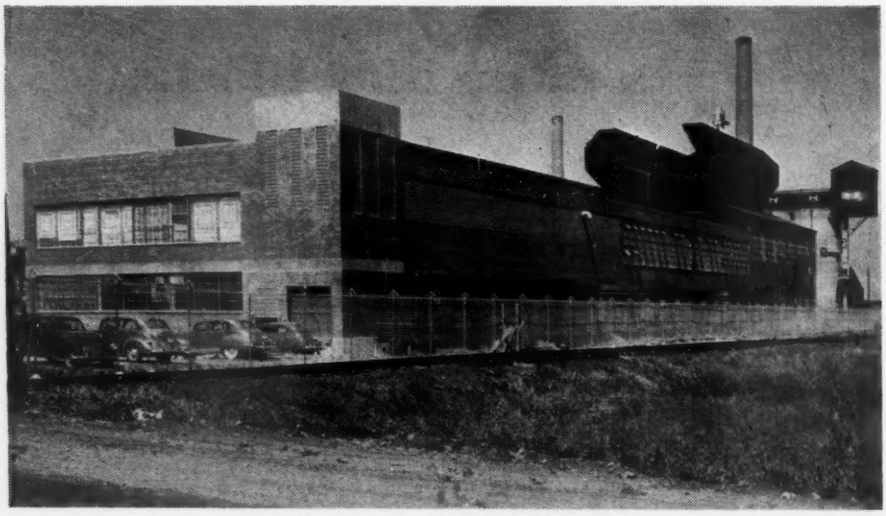
The manufacture of glass blocks is a highly mechanized and complicated process, and in the new plant of the Pittsburgh Corning Corporation recently completed at Sedalia, Mo., they are produced so fast, easily, and methodically as to belie the complicated nature of the procedure. The operations begin with the unloading of the raw materials from railroad cars on the company's spur track. Sand, silica, limestone, and other major ingredients are transferred to three huge concrete silos having outlets in the cullet house, where four automatic scales of 1000 and 2000 pounds' capacity make batch mixing a matter of pulling the right levers. Other constituents, of which lesser quantities are needed, are usually received in bags and added to the batch in the mixing hopper for each furnace charge. A certain amount of broken glass obtained from rejected blocks also goes into the hopper, for a glass plant, like a steel mill, uses some old material with the new. The broken glass is called cullet, from which the cullet house takes its name.

With the ingredients accurately proportioned, the batch is ready for the furnace. Mixing and furnace charging naturally are correctly timed, and the amount of material melted is in proper ratio to the capacity of the block presses. Batches are delivered in storage-battery hopper cars to an elevator that carries them to the roof. From there the material flows to the furnace by gravity under the control of two Frazier-Simplex automatic batch chargers.

In the 200-ton-capacity furnace the mix is heated for a prescribed period to a temperature of 2900°F. by the direct application of gas flames and attains the consistency of molasses. As the furnace operates continuously, its walls must be protected against the deteriorating effect of constant heat. This is accomplished by means of a series of conversion blowers. These automatically and intermittently direct the flames alternately from the sides and ends, thus concentrating the heat on the contents and keeping it away from the walls.

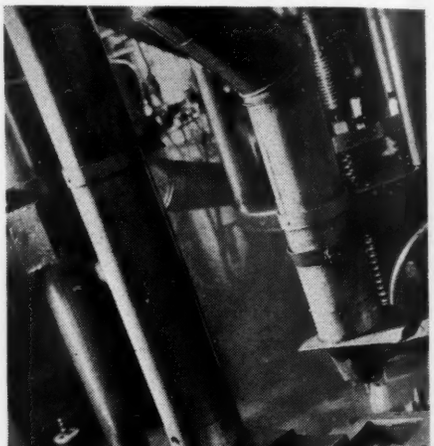
The furnace is of the tank type with mixing and melting compartments that are connected by a submerged throat. Automatic control insures smooth functioning and a product of the desired properties. Tank pressure, stack draft, gas and combustion-air temperature and volume are all maintained within close limits and are either indicated or recorded on a nearby instrument panel where operators check them continually.

From the furnace the molten glass goes to two compressed-air-actuated, duplex pressing machines which can be fitted with varying dies for making blocks of any kind, shape, or size. The molds on these presses rotate somewhat in the manner of a beverage-bottling machine. A viscous glass globule of the correct weight is pumped into each of the traveling molds as they reach the filling position in turn. It is deposited in a female die and, as the male die enters it, pressed into half of a hollow block. The latter continues on its circuit to the delivery station, where two sections are fused together to make a whole block. Before



FACTORY AND BLOCK MOLDS

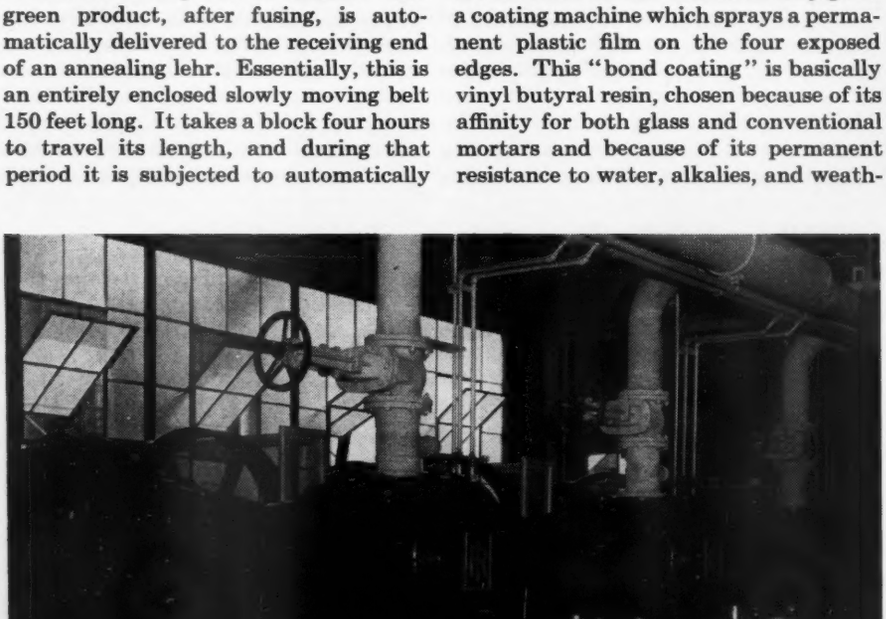
Exterior of the Sedalia, Mo., glass-block plant of the Pittsburgh Corning Company. Below is part of a rotary pneumatic press showing the lower or female dies in which half blocks are formed. In another machine, also air-operated, the halves are fused together along the edges into complete blocks.



this is done, however, the inner space is flushed with a blast of thoroughly dehydrated compressed air. The air trapped at the time of sealing is at very high temperature and is materially reduced in volume through subsequent cooling, thus creating a partial vacuum. Output per machine varies with the size and shape of the product. When making 6-inch corner bricks, it is around seventeen a minute.

Proper annealing of the newly cast blocks is of importance if they are to be tough and durable and resist the effects of weather in any sort of climate. The green product, after fusing, is automatically delivered to the receiving end of an annealing lehr. Essentially, this is an entirely enclosed slowly moving belt 150 feet long. It takes a block four hours to travel its length, and during that period it is subjected to automatically regulated cooling. Upon emerging, it can be handled for visual inspection. Each block is minutely examined by expert operators, and any flaw results in its rejection. Discards are dropped through a steel pipe to the floor below to shatter them, the fragments or cullet eventually becoming part of a subsequent furnace batch.

Portland cement mortar does not adhere readily to glass, and for that reason the edges of the blocks receive special treatment. For this purpose the blocks are slightly heated and the two large surfaces are covered. In this condition they go to a coating machine which sprays a permanent plastic film on the four exposed edges. This "bond coating" is basically vinyl butyral resin, chosen because of its affinity for both glass and conventional mortars and because of its permanent resistance to water, alkalies, and weathering temperatures. The finished blocks are now ready for the shipping room where, after final inspection, they are packed two to a paper carton.



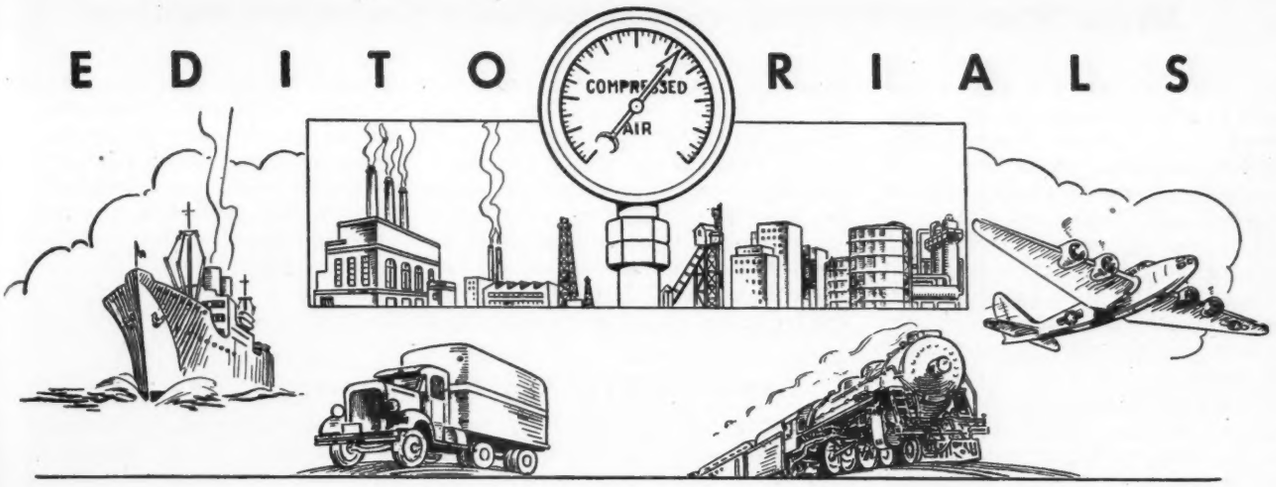
AIR COMPRESSORS

These three synchronous motor-driven machines supply approximately 3000 cfm. of air at 50 psi. for operating molding machines and for other purposes. A fourth and larger unit is being added to serve a foam-glass plant that is at present under construction.

Glass-block plants are users of large volumes of compressed air—the one at Sedalia, for instance, being equipped with three 17x13-inch Ingersoll-Rand machines that are housed in a separate building. Each is driven by a 125-hp. synchronous motor, and all are automatically controlled in accordance with the demand for air from the factory. The discharge-line pressure is 50 psi.

The Sedalia plant is one of two owned by the Pittsburgh Corning Corporation. The other one is located at Port Allegany Pa. O. W. Wiley is manager of operations at Sedalia, and C. E. Carroll, former supervisor of construction for the company, is in charge of maintenance and services. When officially opened late in 1947, the factory was host to nearly 20,000 visitors the first day. On the next day only school children were escorted through, and more than 3000 viewed the spectacle of making glass blocks.

EDITORIALS



ALLOY-STEEL JUBILEE

IN celebration of the seventy-fifth anniversary of the first engineering use of alloy steel, the thirtieth annual Metal Congress and Exposition in Philadelphia, Pa., next month will present as a special feature a "Salute to Alloy Steel." The event is being sponsored by the American Society for Metals and is expected to attract a record attendance from the hundreds of establishments that are concerned with the production and application of metals.

Alloy steel was first applied as an engineering material in the Eads Bridge across the Mississippi River at St. Louis, Mo. This structure, which was justly considered a technical triumph in its day, was opened to service in 1874 and still carries a continually increasing burden of traffic. The world's first steel bridge was constructed in Holland around 1865, but it is generally recognized that the Eads was the first river crossing with engineering alloy steel in its main members.

The development of alloy steel is regarded as an American achievement, and the forthcoming diamond-anniversary ceremonies will stress that fact. A distinction will also be drawn between engineering alloy steels and special-purpose steels. This is considered important in view of the fact that progress in the development of alloy steels is attributable largely to their having been specified for engineering purposes.

During the jubilee, distinguished service awards will be presented for outstanding accomplishments in the science and technology of alloy steels. To make sure that these tributes will go to those who most merit them, the American Society for Metals is inviting nominations from all persons identified with the fields of metal production and consumption. Offhand, it might seem that the foremost contributors to technological advancement would be easy to identify. Nevertheless, it is believed that scores of individuals who originated ideas that led to important results are known only to fellow scientists and workers. The committee that will judge the qualifications of those who are nominated is headed by J. M. Schlendorf, a vice-president of the Republic Steel Corporation.

The medal of the American Society for Metals that is given each year for the advancement of research will go to Dr. Willard H. Dow, head of the Dow Chemical Company of Midland, Mich.

ATOMIC ENERGY POLICIES

ALTHOUGH there are many complaints that our national government encroaches too much on the domain of private business, probably few persons would favor abandoning Federal control of the atomic-energy program that is described in this issue. Certainly no corporate agency or industrial group could have financed the gigantic wartime bomb-producing effort that initiated the project, and none could afford to carry on the extensive continuing work now in progress or projected. Moreover, since the atomic bomb is still an integral part of the whole development, there can be little doubt that direction of it properly belongs in Washington. Those directing the momentous research endeavor are, in true American fashion, giving it all publicity consistent with preserving national security, hopeful that the people, who are paying the bills, will catch something of the spirit of the affair and give it the support it must have to obtain future appropriations.

Actually, the Atomic Energy Commission is only administering the program. The work involved is being done under contracts by leading industrial companies, research concerns, and educational institutions. This policy is being followed to such an extent that even the town of Oak Ridge, Tenn., is operated by the Turner Construction Company. The huge technical and production plants there are run by Carbide & Carbon Chemicals Corporation, while the other uranium processing plant at Hanford (Richland), Wash., is in charge of General Electric Company. Even the facilities at Los Alamos, N. Mex., where bombs are actually brought into being, are managed by the University of California. The numerous research projects that are related to various phases of the program have likewise been delegated to private firms and institutions of higher learning. All told, the Commission has working agreements with 52 colleges and universities.

The Commission has but 5500 persons on its own payroll, and some 700 of these are guards. Contractors' employees, on the other hand, aggregate 55,000. The Washington headquarters of the Commission has a personnel of only 750 including 150 guards. The total administrative budget is around $32,000,000 a year, and $5,000,000 of this is to maintain security.

All of which is in keeping with the policy of letting the principle of free enterprise have as full a rein as possible. Not only does this conform to American tradition, but it is also the most effective way to conduct the program. Only by following this course can the participation of the nation's technical resources and talents be as widespread as desired. During the wartime emergency, the best scientific brains of the country were readily enlisted, but it is not believed that the Government can, under peacetime conditions, offer sufficient incentives to attract and hold the personnel that is required to cope with the problems in hand.

Atomic energy is something to stir the imagination. It is the most adventurous journey into scientific realms ever taken by mankind. One of the hopes of the Commission is that it may interest boys and girls in this epoch-making program and influence them to pursue educational courses that will fit them to assume technical roles in the absorbing drama that will not run down the curtain until the atom has been compelled to yield its innermost secrets.

Sheet Material Coated with Metal in a Vacuum Chamber

BY A CONTINUOUS process now in an advanced stage of pilot-plant operation, the National Research Corporation is applying metallic films to different kinds of paper, fabrics, and plastics in sheet form. The method is the same as that used by optical companies to give lenses an extremely thin coating of metal to increase their light-transmitting qualities by minimizing reflections. The latter was described in the August, 1945, issue.

The work is done in a vacuum chamber in the center of which is a heating element which melts and vaporizes the metal to be deposited. A roll of material is placed at one end of the machine, from which the air is exhausted by means of large vacuum diffusion pumps supplemented by mechanical vacuum pumps. When the metal is reduced to a molten state, the material is wound onto another roll at the opposite end of the chamber, and in its travel it passes over the rising vapor which condenses on the underside of the sheet upon contact, forming a very thin metallic film. After the roll has been processed, the vacuum is broken and the finished product is removed from the chamber. The latter has windows so the operator can watch the progress of the work. Operating speeds depend upon the stock being handled, but rates as high as 500 feet per minute have been attained with varying materials, including paper that was being coated with zinc for making electrical condensers or capacitors. The latter are said to have self-healing properties, promising longer life.

Results obtained seem to indicate that the flexibility of the base material is not affected because of the thinness of the coating. The process is claimed to be more practical than rolling foil, which the film exceeds in brilliance.

Sandwich-Type Building Material of High Strength

BLOCKS of concrete 8x8x16 inches in size are the core of what promises to be a low-cost building material that is now undergoing tests in Dallas, Tex. The blocks are laid in panels without mortar and both surfaces are then coated with Jet-Crete, concrete that is applied by means of a gun with compressed air. Indications are that this sandwich-type wall construction is exceptionally strong and rigid.

The experiments are being conducted for a contractor and a concrete-block maker by the Pittsburgh Testing Laboratories and Southwestern Laboratories. According to their reports, a panel 8 feet high and 10 feet long, reinforced with 6x6-inch wire mesh on one side and covered with mortar ¾ inch thick on both, sustained a live load of 243.6 pounds per square foot without showing signs of strain. For this experiment the slab was placed flat on two angle irons with the unreinforced face down.

In the case of top loading, 23x47-inch unreinforced panels were set upright on two supports 42 inches apart and the weight was concentrated at the center. Those plastered with Jet-Crete 0.51 inch on one side and 0.92 inch on the other failed when the load reached 11,500 pounds, while the conventional type held together by mortar gave way under 4400 pounds. Similarly supported but laid flat, the latter caved in under a center load of 2080 pounds and the coated dry-block wall under 6770 pounds.

Oldest Concrete Structure in the United States?

JUST one day before a group of 104-year-old concrete buildings in Milton, Wis., was to be acquired for a museum, one of the sections collapsed and had to be razed. This happened recently, and interest is focused on the structure because the local historical society considers it to be the oldest of its kind in the United States. Be that as it may, it is a fact that it was constructed by Joseph Goodrich of sand, gravel, and calcined limestone mixed with water. The limestone, it seems, came from Milwaukee.

According to *Homes for All*, a book published in 1850, Goodrich was a prosperous innkeeper. Trade was brisk, and the two log houses with which he started business soon were too small. In 1844 he decided to expand and looked around for a local building material. Lumber was not available in the Wisconsin prairie, and hauling it in over long distances cost a lot of money. It was then that he conceived the idea of using sand, gravel, and limestone and pouring it into forms made of oak planks, which were taken down each day and subsequently served as flooring. "The walls," says the book, "are as hard as stone, or harder," and the author received permission from Goodrich to strike them with a sledge at the rate of six cents a blow—enough to cover the cost of any damage.

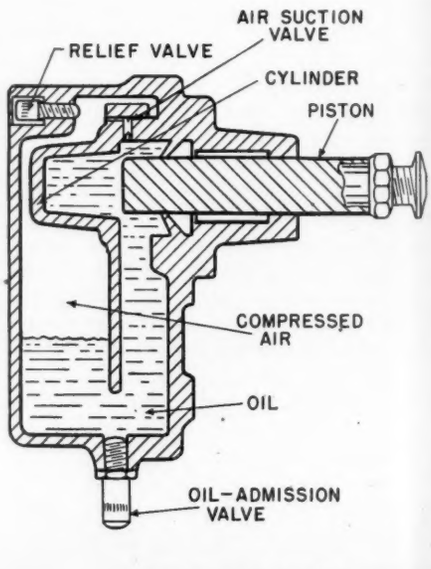
The Milton House was a succession of eight structures two stories high, with a 3-story, 6-sided tower, the proprietor's home. It was a hotel until around 1900, and after that was occupied by a firm of printers and used for storage and, finally, as a rooming house. Six of the original buildings were standing when one of them collapsed. This was not attributed to any weakness in the structure, but to the fact that tenants had weakened the foundation walls by cutting holes through them to reach the basement.

Hydropneumatic Buffer for Looms

FROM Switzerland comes the announcement of a patented hydropneumatic device for looms that serves as a buffer for the shuttle as mechanical pickers throw it back and forth through the shed formed by the warp threads. It is mounted one on each end of the lay or shuttle race, and its purpose is to increase weaving speed.

Before picking starts, the piston of the buffer at that point is at the far end of its stroke. At this stage the housing of the unit is filled with oil as a result of the combined action of the piston and a suction valve. When the picker hits the shuttle, the piston is released and promptly returned to its normal position under the impulse of compressed air exerted against the free surface of the oil.

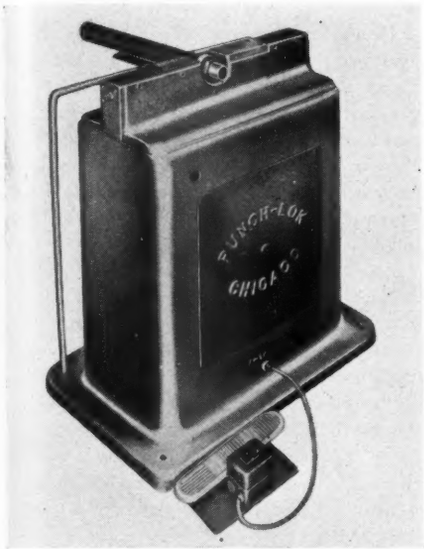
As the shuttle hits the picker on the opposite side of the loom, the moving part of the shuttle-picker-piston group travels a distance equal to the length of the piston stroke, the oil in the cylinder offering resistance to the piston in proportion to its speed. Thus, at a given speed, the shuttle will always stop at the same spot upon impact. It is held there by the swell—a spring-controlled device—until again struck by the picker and thrown through the shed to repeat the performance.



VERTICAL SECTION
Drawing shows the buffer in the starting position with the piston retracted.

Industrial Notes

To simplify the work of applying its Punch-Lok clamp to air-brake and other hose of smaller diameter, Punch-Lok Company has developed a machine that is said to do the job in less than four



seconds. The unit is powered with compressed air and provided with gauges that insure proper tension. When the predetermined tightness is reached, clamp is locked in place and remains leakproof, it is claimed, for the life of the hose.

Checkers and inventory clerks often have to work in poorly lighted places. For their relief, Clyne Manufacturing Company, Cincinnati 14, Ohio, has produced an illuminated tally board called Tally Lite. Of strong construction, it has a heavy-filament 3-volt bulb drawing current from three standard flashlight batteries. The whole thing weighs 24 ounces.

Sheets of asphalt-impregnated paper used in curing freshly laid concrete are converted into a single blanket by a machine designed by the Minnesota Mining & Mfg. Company. The unit weighs 33 pounds and pays out Scotch Wetordry tape as fast as a man pushes it along. Tape sticks tight on contact but strips off easily, it is claimed, when concrete has set, permitting repeated reuse of full width of paper.

Johns-Manville has announced the development of two fast air-hardening refractories—3X Firecrete and 3X Blazecrete—for service at temperatures up to 3000°F. Both can be applied by troweling, casting, or gunning. However, the first-named is recommended for pouring or casting special shapes such as burner blocks, door linings, furnace covers, and complete linings, while Blazecrete was made to be shot in place or applied by trowels where the use of pneumatic guns is impracticable. The latter refractory is suitable for repair work and new construction. The materials are said to have high resistance to spalling and to be ready for service within 24 hours after application.

Alfograf is the trade name of a colloidal graphite for spray application on aluminum, magnesium, and steel that is to be formed, stamped, or forged. The liquid serves primarily as a carrier to disperse the graphite on the metal, where it acts as a lubricant between metal and dies to prevent cutting, galling, and scratching. The film is left on the metal and tool surfaces at the conclusion of the operations to protect them against corrosion.

Preserving fruits on a commercial scale involves many problems such as consistently retaining flavor and color, especially of berries, and handling the fruit without crushing. All this is accomplished, it is claimed, by the use of a vacuum unit that eliminates pumping. It features a quick changeover to pneumatic pressure by which the material is forced out of the vacuum pan to the next operation that may be on the same level or on the floor above or beneath.

Twisting and kinking of hose carrying air, water, etc., is eliminated, we are informed, by a new swivel connection patented by Dixon Valve & Coupling Company. Consisting of but two metal parts and a gasket, the unit is said to respond freely to every turning motion of a hose and to remain leakproof under normal working pressures. Sealing is effected by the gasket, which expands with increasing pressure. The connection is being distributed through dealers of hose and mechanical rubber goods and is available in ½- and ¾-inch internal-pipe-thread sizes.

Through the development of a new brazing technique, it is now practicable, according to reports, to join parts of high-temperature stainless steel necessary in the construction of jet engines and rockets. While brazing itself is essentially the same as before, the difficulties previously encountered are overcome by doing the work in an atmosphere of pure hydrogen. Copper is placed adjacent to the edges to be bonded so that it will flow into the joints when molten, and the assembly is then put in a box that is charged with hydrogen and sealed. This container is introduced into the heating chamber of an electric furnace, where it remains from twenty minutes to an hour. However, before the container is removed, nitrogen is substituted for the hydrogen because the latter gas combined with air is an explosive mixture.

Adhesive 100 percent pure and somewhat like cellophane in appearance is a new product of the Minnesota Mining & Manufacturing Company for bonding a wide variety of materials. Called Scotch-Weld Bonding Film, it is sandwiched between the members to be united and then cured by the simultaneous application of heat and pressure ranging, respectively, from 300 to 500°F. for 5 to 60 minutes and from 25 to 100 psi., depending upon the bond desired. According to the manufacturer, metal-to-metal bonds were resistant to shear tests up to 3500 psi. In the case of 0.064-inch aluminum Alclad bonded to fiber, wood, and plastics, the nonmetallics delaminated at 880, 1770, and 2800 psi., in the order named, but the adhesive held. Scotch-Weld is not tacky to the touch and is said to be inert to water, oils, and most solvents. It is provided in rolls like tape.

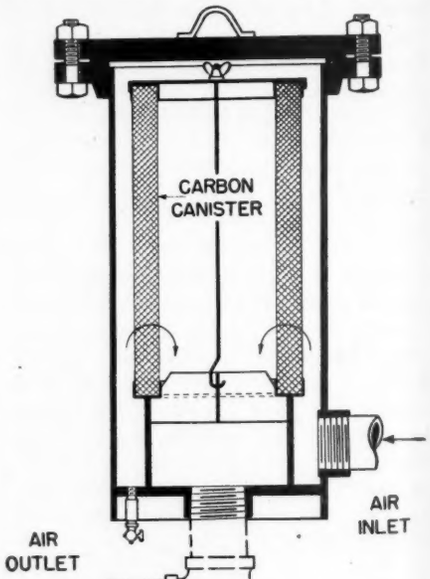
Among the presses of new design and manufacture is one for drawing and embossing thermoplastic sheet material. The machine is built by the Taber Instrument Corporation and produces circular, oval, or odd shapes by the use of interchangeable dies from blanks and strip or sheet stock ranging in thickness from 0.005 to 0.020 inch. The press is operated by a double-acting pneumatic cylinder and is coupled to a hydraulic intensifier. Air at 80-100 line pressure is used and regulated by a 4-way solenoid valve tied in with an electronic timing and switching arrangement that controls the hydraulic fluid. Pressure of two buttons on the worktable starts the cycle, which is automatic through to the

return of the ram to the starting position. Ram speed is adjustable, and pressures may be varied from a slight touch up to 2500 psi. The Model 129, as the press is designated, produces cup-shaped objects having a maximum diameter of 4 inches and a depth normally not exceeding 2 inches.

Ready mixed and available in white and five pastel colors, Fire Stop is a new paint suitable for coating wallpaper, plaster, concrete, wood, steel, or composition materials. It is a product of Plicote, Inc., and is said to form only brown blisters upon exposure to a Bunsen-burner flame of 3000°F. for one minute.

As the name Highflex indicates, the new ¼-inch oil-resistant hose produced by Goodrich for small pneumatic tools is flexible and resistant to high pressures—up to 250 psi. It is claimed that the outer jacket resists cutting and abrasion and that the inner tube is proof against flaking. Highflex is red in color and weighs 11.2 pounds less per 100 feet than the displaced ¼-inch hose.

To its Dorex line of compressed-air purifiers, the W. B. Connor Engineering Corporation has added the Type PL which is designed especially to eliminate fermentation odors and to extract contaminants from air used to agitate foodstuffs, medicinal products, cosmetics, etc. The adsorption medium is activated carbon packed in a removable can-

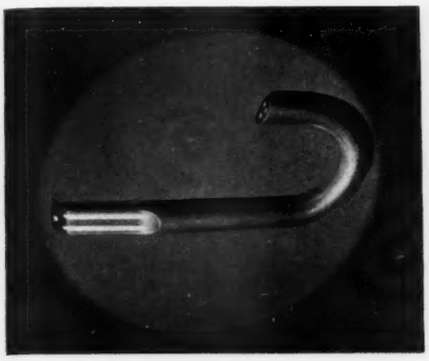


ister housed in a steel shell complete with internal manifold and drain connection. The unit can be readily interposed in the air line, and refilling does not necessitate breaking pipe connections. Standard units are built for a

working pressure of 125 psi. and a maximum air temperature of 100°F.

There are 55 miles of nylon cord in the Goodrich 56-inch airplane tire used on the Boeing 377 Stratocruiser.

Heretofore made only with a rosin-filled flux for radio and electrical work, Alpha Tri-Core solder is now available with a chalklike acid flux for stainless steel, monel, nickel, and other metals, excepting aluminum and magnesium that are usually not solderable with a core solder. The flux is a synthetic non-liquid acid that is said to be considerably more active than zinc chloride even though only half as corrosive. It is soluble in water and easily washed off. The 3-core construction promotes melting and provides the right amount of flux when the solder begins to flow, thus insuring strong, dependable bonds. The new product of Alpha Metals, Inc., comes in 1-, 5-, and 20-pound spools.



Instructions for machinery erection, operation, and maintenance that are indestructible and always available when needed are an idea of the American Name Plate & Manufacturing Company. That concern is engaged in the business of etching the information with illustrations, if necessary, on metal plates that are attached in a conspicuous place on the equipment itself.

For set-up work, tack welding, and similar jobs where the use of a welding helmet is impracticable, American Optical Company is offering a small hand shield made of a special fiber. It is shaped like the familiar helmet and has a 5½-inch handle and a glass holder of steel. The shield is available with a standard Noviweld or Filterweld plate and weighs 11 ounces without the glass.

Rubber, cotton, asbestos, and Fiberglas have been combined to form a new belt for handling materials at temperatures up to 350°F., primarily foundry sand after knockout operations. Of six plies, the conveyor is about ½ inch thick. It is made by Hewitt-Robins, Inc., in 18-, 20-, and 24-inch widths and can be laced with Flesco or Alligator fasteners.

Industrial Literature

General Electric Company, Pittsfield, Mass., will send upon request a 30-page illustrated bulletin giving details of the silicone products manufactured by its Resin and Insulation Materials Division. The booklet covers silicone resins, oils, greases, water repellents, and rubber, and lists their industrial uses.

Stainless piping systems are the subject of Bulletin 483 recently issued by Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill. It contains drawings, dimensions, and prices of new types of fittings and flanges available in stainless steel, nickel steel, Monel, Inconel, and other corrosion-resistant materials.

Research workers may be interested in a bulletin obtainable from Brooks Rotameter Company, P. O. Box B-47848, Lansdale, Pa., that describes a research kit equipped for measuring flow rates in liquids and gases. The kit is designed to measure nineteen liquid flow ranges from 0.1 to 275 cubic centimeters a minute and nineteen gas flow ranges from 10 to 10,500 ccm.

Wirebound boxes and crates are the subject of *Your Product in Wirebounds*, a booklet prepared by the Wirebound Box Manufacturers Association. It is intended to acquaint those concerned with packing industrial products for shipment with the advantages of wirebound boxes, and demonstrates the use of such containers for export as well as domestic trade. The many types, sizes, and styles are discussed, and examples of products now being shipped in them are given. The booklet may be obtained by writing to the association at 105 South La Salle Street, Chicago 3, Ill.

Ingersoll-Rand Company has issued an 8-page bulletin which describes the latest addition to its line of portable air compressors. It is a self-contained, air-cooled, gasoline engine-driven unit having an output of 37.5 cfm. at 80 psi. pressure. The compressor and engine are mounted on a tubular air receiver which, in turn, is mounted on two pneumatic tires and fitted with a trailer hitch for towing behind a truck or automobile. The portable was designed for use with the company's J-10 Jackhamer for work such as chipping, drilling holes for anchor bolts, roughing concrete for patching, tearing out brick and masonry, drilling holes for the installation of pipes or electric cables, breaking boulders, etc. The bulletin may be obtained by requesting Form 145 from the company at 11 Broadway, New York 4, N. Y.

Lubrication of Air Drills and Compressors is the title of a 32-page manual recently issued by The Texas Company. Prepared by its technical and research division, the manual is intended as an aid in the selection of the proper oil for each type of compressor and air drill. Numerous drawings and cutaway views of drills and compressors explain the construction of each and its lubricating system. Data on the selection of compressor oils give the amount required by each machine and the effects of using unsuitable oils. Similarly, lubricants for air drills are recommended according to the type and the conditions under which it operates. The manual also contains tables giving the effect of altitude on drill requirements, the correction of compressor capacity at different elevations, and atmospheric pressure and barometer readings for different altitudes. Requests for copies of the manual should be addressed to the company at 135 East Forty-Second Street, New York 17, N. Y.